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REPORT

ON THE

Second Imperial Mycological Conference 1929.

IMPERIAL MYCOLOGICAL INSTITUTE
5 SEPT 1935

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New Timber Place,
Hassocks, Sussex.
28th October, 1929.

My Lord,

I have the honour to transmit to you the Report of the Second Imperial Mycological Conference, which was held in London from the 23rd September to the 28th September.

2. In August, 1924, I had the honour to submit to Mr. J. H. Thomas, then Secretary of State for the Colonies, the report of the first Imperial Mycological Conference, held in July of that year. Among the Resolutions adopted at that Conference was one to the effect that, in view of the benefits derived from an exchange of views between overseas mycologists, similar conferences should be held every five years. It was in pursuance of that Resolution that the recent Conference was convened ; and I am happy to be able to inform you that it was in every way as successful as the first Conference, and completely fulfilled the high expectations with which it had been awaited. This fact was emphasized by the action of the delegates in unanimously reaffirming the Resolution passed at the first Conference, to which I have referred.

3. Although certain Dominion and Colonial Governments unfortunately found it impossible to send delegates, the Conference was widely representative : and the value of the discussions was considerably enhanced by the presence and participation of many visitors, some of whom attended as representatives of Government Departments, research institutions, and similar bodies in this country and overseas. The discussions themselves lasted for a full week, as compared with only three and a-half days on the occasion of the first Conference, and were fully attended, were of great interest and value, and were conducted throughout in an admirable and helpful spirit. Apart from the actual discussions, the Conference afforded ample opportunity for what is one of the most valuable features of such meetings—the possibility of close personal contact between workers in kindred scientific subjects from different parts of the Empire.

4. In the week following the Conference discussions in London, excursions were arranged for the delegates to the Research Stations at East Malling, Rothamsted, Long Ashton, and Cambridge. The opportunity which these visits gave for the oversea delegates to see at first hand some of the research work carried out in this country was much appreciated, and warm thanks are due to the authorities of the research institutions concerned, who spared no trouble to make the visits enjoyable and valuable.

5. There is, I think, no need for me to comment in detail in this letter on the Resolutions adopted by the Conference and set out * in the enclosed Report. These will be considered by the Managing Committee of the Imperial Bureau of Mycology at its next meeting, and any observations which the Committee may make in regard to them will be communicated to you. But I desire to take this opportunity of inviting your Lordship's attention to the report of the sub-committee set up by the Conference to examine the organization and the financial position of the Imperial Bureau of Mycology. This report, which was adopted unanimously by the Conference, and which is printed as an appendix † to the main Report, was drawn up after the sub-committee (which was fully representative) had given the most full and careful consideration to the question of what income and organization would be necessary for the Bureau, if the assistance which it has given in the past to Agricultural Departments overseas is to be maintained and, where necessary, extended in the future. I earnestly trust that the additional financial assistance which the sub-committee decided was essential for the proper maintenance and extension of the Bureau's work may be speedily forthcoming. Among the most gratifying features of the recent Conference were the constant tributes paid on all sides to the value and importance of the Bureau's work, and it is because I am particularly anxious that this should not be impaired that I have ventured to draw special attention to the sub-committee's report. I may perhaps add that it is desirable that action on this report should be taken at an early date, as the contributions at present paid to the Bureau by oversea Governments were guaranteed only to the end of the current financial year.

6. I desire to express thanks, on behalf of all who attended the Conference, to the authorities of the Imperial College of Science and Technology, who again placed rooms at the disposal of the Conference for its meetings. I would finally express appreciation of the hospitality which was extended by His Majesty's Government in the United Kingdom to Conference delegates and members of the Bureau Managing Committee at the dinner given to them on the evening of the 23rd September.

I have, etc.,

BUXTON.

Chairman of the Second
Imperial Mycological Conference.

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* See page 12. † See page 35.

Letter from the Secretary of State for Dominion Affairs and the Colonies to the Right Hon. the Earl Buxton, G.C.M.G.

DOWNING STREET,
7th November, 1929.

MY LORD,

I HAVE the honour to acknowledge the receipt of your letter of the 28th October, forwarding the Report of the Second Imperial Mycological Conference, which was held in London from the 23rd to the 28th September.

I am glad to learn that the Conference was so successful, and that its discussions, and the excursions which followed them, gave opportunity not only for the examination of current mycological problems from many points of view, but also for close personal association between the delegates and visitors from overseas and research workers in this country. I fully share your view that this personal association is one of the most important features of meetings like the recent Conference.

I shall give my most careful consideration to the Report and recommendations of the Conference and, in particular, to the report (to which you have been good enough to draw my special attention) submitted by the Conference sub-committee which examined the financial position and organization of the Imperial Bureau of Mycology. I am fully cognisant of the value of the work performed by the Bureau, and I share your anxiety that this should not be impaired in any way in the future.

Finally, I desire to take this opportunity of expressing my appreciation of the services rendered by members of the Managing Committee, who, in spite of many calls on their time, have so ably assisted in the administration of the Bureau ; and, in particular, I am grateful to you, as Chairman, for responding so generously to the claims of the Bureau on your time and interest, especially in connection with the recent Conference.

I have, etc.,

PASSFIELD.

REPORT ON THE SECOND IMPERIAL MYCOLOGICAL CONFERENCE, 1929.

1. Calling of the Conference.

At the first Imperial Mycological Conference, held in July, 1924, a Resolution* was passed in the following terms :—" That, in view of the benefits derived from an exchange of views between overseas mycologists, conferences similar to the present one should be held every five years." The Managing Committee of the Imperial Bureau of Mycology discussed early in 1928 what arrangements should be made to give effect to this Resolution ; and, after full consideration, decided to recommend to the Secretary of State for Dominion Affairs and the Colonies that a second Conference should be convened in London towards the end of September, 1929. The Secretary of State accepted this recommendation and, accordingly, all those Dominion and Colonial Governments who contributed to the support of the Bureau were invited to designate delegates to attend the Conference at the date suggested. The Governments of 'Iraq and of the Sudan were also invited to send representatives.

2. Delegates.

The following delegates were designated to attend the Conference :—

A.—Dominion Governments.

CANADA—DR. H. T. GÜSSOW.
COMMONWEALTH OF AUSTRALIA—DR. E. J. BUTLER, C.I.E.
NEW ZEALAND—DR. G. H. CUNNINGHAM.
IRISH FREE STATE—DR. P. A. MURPHY.
INDIA—DR. E. J. BUTLER, C.I.E.
SOUTHERN RHODESIA—MR. E. J. WORTLEY, O.B.E.

B.—Colonial Governments, etc.

BRITISH GUIANA—MR. S. F. ASHBY.
CEYLON—MR. F. A. STOCKDALE, C.B.E.†
FIJI—MR. J. G. C. CAMPBELL.
GAMBIA—MR. A. J. BROOKS.
GOLD COAST—MR. R. H. BUNTING. MR. H. A. DADE.
JAMAICA—MR. F. E. V. SMITH.
NYASALAND—MR. E. J. WORTLEY, O.B.E.
PALESTINE—DR. I. REICHERT.
SIERRA LEONE—MR. F. C. DEIGHTON.
STRAITS SETTLEMENTS ... MR. F. W. SOUTH.
FEDERATED MALAY STATES MR. W. N. C. BELGRAVE.
TANGANYIKA TERRITORY—MR. C. B. WILLIAMS.
TRINIDAD—MR. W. G. FREEMAN.

* See page 7 of Non-Parliamentary Publication, Colonial No. 8, 1924.
† Also attended in his capacity as Assistant Agricultural Adviser, Colonial Office.

Uganda—Mr. C. G. Hansford.
Imperial College of Tropical Agriculture, Trinidad (and Government of Barbados)—Prof. H. R. Briton-Jones.

Major R. O. Archibald, C.M.G., D.S.O., and Mr. R. E. Massey attended in the capacity of experts loaned by the Government of the Sudan.

Visitors.

Invitations to send representatives as visitors to the technical discussions of the Conference were issued to the Ministry of Agriculture and Fisheries, the Empire Marketing Board, and other Government Departments in England, Scotland, and Northern Ireland : to Agricultural and Horticultural Research Stations, at home and overseas ; and to the Empire Cotton Growing Corporation, the British Cotton Growing Association, the British North Borneo Company, and similar organizations. The majority of the Departments and institutions invited were fortunately able to send representatives to attend the Conference and their presence was much appreciated.

In addition, some forty individual mycologists in the United Kingdom were invited to attend, and many were able to do so.

The Government of Egypt allowed three of its mycologists to attend, as visitors, the Conference discussions : and Professor Westerdijk, of the University of Utrecht, also attended several of the meetings and at one of them gave an account of the Centraal bureau voor Schimmelcultures at Baarn.

3. Arrangements for the Conference.

Consideration of the detailed arrangements for the Conference was entrusted to a small sub-committee of the Managing Committee of the Imperial Bureau of Mycology, consisting of Dr. Butler (Director) as Chairman, Professor Blackman, Mr. Brooks, Dr. Murphy, Sir David Prain, and Mr. Lee (Colonial Office) as Secretary.

This sub-committee examined the suggestions which had been made by oversea Governments in regard to the Conference agenda, and prepared a provisional list of agenda based on these which, before definite adoption, was submitted to the Governments concerned for their observations. The sub-committee also made detailed arrangements in regard to accommodation for the Conference, the excursions for delegates to research institutions and related matters. As on the occasion of the first Conference in 1924, the authorities of the Imperial College of Science and Technology, South Kensington, kindly placed a lecture theatre and other rooms at the disposal of the Conference : and, in addition, allowed those attending it to partake of meals at the College Union.

The arrangements made by the sub-committee were reported to, and confirmed by, the full Managing Committee ; which also approved a report submitted to it by its Finance sub-committee on

the organization and financial position of the Bureau. This latter report was taken as the basis for the discussions of the Conference sub-committee on this subject.

4. Programme.

The following programme was arranged for the Conference :—

Monday, 23rd September.

11 a.m.—Opening of the Conference by the Right Hon. the Earl Buxton, P.C., G.C.M.G., Chairman of the Managing Committee.

11.30 a.m. to 1 p.m.—(i) Discussion of Subject I—"The Work and Organization of the Imperial Bureau of Mycology."

(ii) Appointment of Committees to consider—

(*a*) the financial position of the Bureau ;

(*b*) the formulation of a standard method of handling dangerous material (specimens and cultures) in mycological laboratories.

(iii) Resolutions regarding—

(*a*) the publication of an abstracting journal for the literature on mycological systematy ;

(*b*) the need for a series of handbooks on the diseases of tropical and sub-tropical crops.

2.30 p.m. to 4.30 p.m.—Discussion of Subject II—"Root Diseases of Orchard and Permanent Plantation Crops, with special reference to the relative importance of the various Fungi Concerned."

Tuesday, 24th September.

10 a.m. to 1 p.m.—Discussion of Subject III—"The existing organization of Plant Pathological (Plant Protection) Services in various parts of the Empire."

2.30 p.m. to 4.30 p.m.—Discussion of Subject IV—"Field inspection and Certification of Crops as a basis for the prevention of disease."

Wednesday, 25th September.

10 a.m. to 1 p.m.—Discussion of Subject V—"Virus Diseases."

2.30 p.m. to 4.30 p.m.—Discussion of Subject VI—"Practical Difficulties in the administration of Plant Protection Regulations and the possibility of laying down a Standard Minimum Requirement for preventing the importation of Diseased Plant Material."

Thursday, 26th September.

10 a.m. to 1 p.m.—(i) Discussion of Subject VII—"Seed-borne Diseases, with special reference to (*a*) Standard Methods of determining percentage of infection, (*b*) Standard Methods of seed treatment, (*c*) Legislation governing the export and import of Seeds."

(ii) Discussion of Subject VIII—"Organization of Spray Services based on Weather Predictions."

2.30 p.m. to 4.30 p.m.—Discussion of Subject IX—"Epidemiology of Common and Widespread Diseases in Cereals, including Rusts and Smuts."

Friday, 27th September.

10 a.m. to 1 p.m.—(i) Discussion of Subject X—"Diseases developed in Fruit shipped overseas, including Bitter Pit and Storage Troubles."

(ii) Discussion of Subject XI—"Soil-borne and soil-induced diseases (parasitic and non-parasitic), including those of Cereals."

2.30 p.m. to 4.30 p.m.—Papers on the following subjects :—

(i) Methods of obtaining standardized proprietary Disinfectants, with special reference to (*a*) Coal-tar derivatives, (*b*) Mercuric compounds.

(ii) Witches' Broom disease of Cacao.

(iii) The breeding of a Commercial Lime immune from Withertip disease.

(iv) The deterioration of produce by Moulds.

Saturday, 28th September.

10 a.m. to 1 p.m.—(i) Discussion of Subject XII—"The Control of Insect Pests by entomogenous fungi, with special reference to island conditions."

(ii) Reports of Sub-Committees.

(iii) Resolutions.

(iv) Close of Conference.

2.30 p.m. to 4.30 p.m.—Visit by Conference delegates to Bureau and the Royal Botanic Gardens, Kew.

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5. Government Dinner to Delegates and members of the Bureau Managing Committee.

A dinner was given at Lancaster House by His Majesty's Government in the United Kingdom on the evening of the 23rd September to delegates and members of the Managing Committee of the Imperial Bureau of Mycology. The Right Honourable the Lord Passfield (Secretary of State for Dominion Affairs and the Colonies) presided, and proposed the toast of "The second Imperial Mycological Conference," to which the Right Honourable the Earl Buxton responded.

6. Opening of the Conference.

The Conference was opened by Earl Buxton at 11 a.m. on the 23rd September. After extending a warm welcome to the delegates and visitors, he expressed his conviction of the value of such meetings

and his hopes that the Conference would prove as completely successful as had the first Conference, which he had opened in 1924. He reviewed briefly the work done by the Bureau since 1924 and the possibility of its expansion : and paid a warm tribute to the efforts of Dr. Butler and the Bureau staff, and the valuable and constant co-operation of the Honorary Managing Committee.

7. Finance and Organization of the Bureau.

After Lord Buxton's opening speech Dr. Butler gave a full review of the activities of the Bureau since the Conference in 1924, and explained in detail the steps which had been taken to give effect to the various Resolutions passed by that Conference. He also outlined various new branches of work which the Bureau had undertaken during the past five years : and emphasized the great convenience and advantage which was expected to result from the occupation of the new building in 1930. He concluded by a brief statement of the Bureau's financial position and probable requirements in the future.

After some further discussion in regard to the organization and financial position of the Bureau during which various suggestions were made for increasing the usefulness of the Bureau, the Conference decided that this subject and the suggestions put forward should be considered by a sub-committee, which was constituted as follows :—

> Dr. A. W. Hill, C.M.G. (Chairman), Dr. Pethybridge (Managing Committee), Dr. Güssow, Dr. Cunningham, Mr. South, Mr. Brooks, Mr. Freeman, Mr. Dade, Mr. Smith, Dr. Butler (Director), with Mr. Lee as Secretary.

The report of this sub-committee is printed as Appendix II* to this Report. The main conclusion of the sub-committee taken after a full enunciation of the position was that if the normal work of the Bureau was to be carried out successfully in the future, an income of £1,200 would be required in addition to its average normal income for the period 1924–29. The minutes of a Finance Sub-Committee of the Bureau Managing Committee, and a financial statement prepared by the Director of the Bureau, which formed the basis for the Sub-Committee's discussions, are also printed in Appendix II.

The sub-committee's report was, subject to some minor verbal amendments, unanimously adopted by the Conference.

At the opening session sub-committees were also set up to examine (*a*) the formulation of a standard method of handling dangerous materials in mycological laboratories, and (*b*) the preparation of a series of handbooks on the diseases of tropical crops.

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* See page 35.

The reports of these sub-committees are printed as Appendices III and IV* to this Report, and their adoption by the Conference embodied in Resolutions Nos. 10 to 12 and No. 2, respectively.

8. General Discussions of the Conference.

A summary of the general discussions of the Conference is given in Appendix I† to this Report.

9. Visits to Research Stations.

In the week following the Conference discussions in London, excursions were arranged for delegates on 30th September, 1st, 2nd and 5th October, to research institutions at East Malling, Rothamsted, Long Ashton, and Cambridge. The research work which the delegates were enabled to see and to discuss at these Institutions was of great interest to them and the consideration and hospitality extended by the respective authorities were warmly appreciated. Many delegates availed themselves of the opportunity, following the visit to Long Ashton on the 2nd October, to join on the 3rd and 4th October the annual field meeting of the British Mycological Society at Bristol.

Resolutions.

The following Resolutions were adopted by the Conference :—

1. That this Conference urges that the necessity for an abstracting Journal of the world's literature on Mycological Taxonomy be referred to the International Botanical Congress, Cambridge, 1930.

2. That this Conference accepts the report‡ of the Committee appointed to consider the need for a series of handbooks on the diseases of tropical and sub-tropical crops and recommends that it be referred to the Managing Committee of the Imperial Bureau of Mycology for such action as may be necessary to give effect to it.

3. With a view to protecting the staple agricultural crops of a country, this Conference recommends that the Government thereof should include in its Plant Protection Legislation provisions for growing under quarantine of stock for propagation capable of introducing diseases which may affect such staple crops, and should take measures to ensure that such quarantine can be effectively carried out by or under the supervision of the agricultural authority.

4. The Conference notes the recent outbreak of witch broom disease of cacao in Trinidad and suggests that the attention of the British West African Colonies should be drawn to the desirability of co-operating with neighbouring countries in

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* See page 41. † See page 15. ‡ See Appendix IV., page 41.

West Africa in devising steps which will satisfactorily provide against the possible introduction of this disease into West Africa.

5. The Conference suggests that the attention of the Governments of Malaya and Ceylon should be drawn to the desirability of investigating the possibility of treating bud-wood of rubber against diseases before import.

6. In order to facilitate protective legislation and possibly to further our knowledge of the means by which diseases spread or are introduced from one country to another, it is desirable to obtain, in a form readily accessible and up-to-date, full information in regard to the distribution of diseases of crop plants throughout the world. For this purpose, this Conference recommends that provision be made for the necessary work to be undertaken at the Imperial Bureau of Mycology and that the tropical Colonies should make arrangements for group notification.

7. This Conference is of opinion that the system of certificates is one which should be universally recognized but that the acceptance of such certificates should not be allowed to imply that importing countries should in any way waive their right of prohibiting, inspecting, treating, quarantining, and destroying, where necessary, plant imports. It further recommends that steps should be taken to arrange that exporting countries within the Empire should specify as nearly as possible the significance of their certificates covering plant exports.

7*a*. This Conference also recommends that the form of certificate of inspection appended (see Appendix 1A)† be submitted for approval to the Ministry of Agriculture and Fisheries in the first instance and then to the Dominions and Dependencies within the Empire, and, if approved, that it then be adopted.

8. This Conference recommends that countries between which planting material frequently passes should endeavour to group themselves together and investigate the possibility of finding a minimum treatment for any specific pest or disease of a particular plant of which the export is required.

9. That research work relative to the important question of seed-borne disease be given increased attention throughout the Empire, if necessary by the appointment of one or more specialists to the respective plant pathological services, and that such investigations be co-ordinated with the duties of seed-testing stations.

10. That this Conference approves the draft* prepared by the Committee appointed to formulate a standard method of handling dangerous material (specimens and cultures) in mycological laboratories, and recommends that it be circulated to mycologists throughout the Empire.

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* See Appendix III, page 41. † See page 34.

11. That special care be taken in the handling of dangerous specimens in mycological laboratories where teaching is carried on.

12. That teachers of plant pathology, if they do not do so already, give careful consideration to the possible risks of introducing cultures of plant pathogenic organisms into countries where diseases caused by those organisms do not occur.

13. The Conference, appreciating the valuable help that has been given to the Plant Protection Services by the Meteorological Departments in various parts of the Empire, urges the need for further co-operation and, especially, for the more precise formulation by plant pathologists of the data which they would like to obtain.

14. The Conference expresses warm appreciation of the services rendered to mycology and plant pathology by the Centraalbureau voor Schimmelcultures at Baarn, under the direction of Professor Westerdijk, and desires to bring them prominently to the attention of mycologists and plant pathologists throughout the Empire in the hope that means may be provided for continuing and developing the work of the Bureau on a still more satisfactory basis.

15. The Conference wishes to place on record its view of the desirability of the republication of certain important mycological works that can no longer be obtained, and requests that the necessary steps should be taken to ensure that this matter is discussed at the International Botanical Congress at Cambridge in 1930.

16. That this Conference accepts the report of the sub-committee set up to examine the financial position and organization of the Imperial Bureau of Mycology, and earnestly hopes that the additional financial assistance which the sub-committee regards as essential for a proper continuance of the Bureau's work may be forthcoming.

17. That this Conference reaffirms the fifth Resolution adopted at the First Imperial Mycological Conference, namely, that in view of the benefits derived from an exchange of views between overseas mycologists, Conferences similar to the present one should be held every five years.

Votes of Thanks.

A cordial vote of thanks was passed by the Conference to the authorities of the Imperial College of Science and Technology for the use of their rooms for the meetings of the Conference, and for the excellent catering arrangements for delegates and visitors. The Conference also conveyed its thanks to Dr. Butler and other Executive Officers of the Imperial Bureau of Mycology who, by their unremitting efforts, had brought about the success which had attended its meetings.

APPENDIX I.

Imperial Mycological Conference, September, 1929.

Meeting: *Monday, 23rd September*, 2.30 *p.m.*

Chair: Mr. F. T. Brooks.

Discussion: **"Root diseases of orchard and permanent plantation crops, with special reference to the relative importance of the various fungi concerned."**

Prof. Briton-Jones (Imperial College of Tropical Agriculture, Trinidad) in opening this discussion reviewed in detail the records of *Macrophomina phaseoli* under its various names from the earliest reference to the disease on sweet potato by Halstead in 1890. The records showed the disease to be widely distributed on a large number of hosts in tropical and sub-tropical countries. Taubenhaus in 1913–14 was the first to state quite clearly the secondary importance of the fungus and the speaker stressed somewhat the various opinions of other writers in support of this view. Small, in Ceylon, expressed the contrary opinion in various papers published between 1926–29 and regarded the fungus as a true parasite, whilst other organisms, formerly considered to be primary parasites, he relegated to a secondary position. Gadd was quoted as holding the view that the fungus is a pure saprophyte, while Park suggested that it might function as a mycorrhizal symbiont. Some support for Small had been forthcoming from Steinmann in Java and Hansford in Uganda; but the speaker was inclined to a middle course and to regard the fungus as a facultative parasite when conditions favoured its development. Investigations on the parasitism of the fungus recently carried out by West and Stuckey under his direction afforded definite evidence of the correctness of this view and were very fully described. Many of the attempts to secure infection under various conditions were unsuccessful, but of the others it might be mentioned that jute seedlings grown under moist conditions succumbed within two days of inoculation. Cotton seedlings, grown in pure sand, transplanted to an infected field and manured, became heavily infected, while pot experiments with soil from the same field treated with various fertilizers gave one plant killed on the manured and 18 on the unmanured. Tests of the pathogenicity of *M. phaseoli* and *Diplodia* to cotton plants growing under varying conditions of moisture and growth suggested that defoliation might result in predisposing the plants to disease, and further experiments corroborated this view. The effect of defoliation on the plants would be to produce a low carbohydrate-nitrogen ratio and the authors suggest that any physiological factor which upsets this ratio may render the plant susceptible. With regard to the parasitism of *Rosellinia* and *Fomes lignosus* the speaker agreed that the former was a parasite but he did not think that the fungus known under the latter name in Trinidad could be considered virulent.

Mr. Ashby (Imperial Bureau of Mycology) followed with a note on the application of the combination *Rhizoctonia bataticola* (Taub.) Butl. It was pointed out that the binomial had been used in Ceylon to cover three strains referred to as A, B, and C strains. It was applicable in the strict sense only to the C group which form minute black sclerotia about 100μ or less in diameter and have *Macrophomina phaseoli* as a pycnidial stage of which *R. bataticola* is, therefore, a synonym. The C strains also cause a charcoal rot of sweet potato. The B strains are characterised by the production of sclerotia about 200μ in diameter, while the sclerotia of the A strains run to 0.5 mm. or 1 mm. or more in size. Evidence has not yet been furnished that a pycnidial stage occurs in the life cycle of the A and B forms nor that they are able to produce a charcoal rot of sweet potato. The binomial *R. bataticola* can therefore be used at present only provisionally for these two forms.

Mr. Hansford (Uganda) stated that his experience coincided with that of Dr. Small in Ceylon to a large extent. He was convinced that the fungus was primarily parasitic on coffee, on which host it was quite common in Uganda, preceding *Fomes lamaoensis* which was secondary.

Mr. Stockdale (Ceylon) thought that Dr. Briton-Jones had rather exaggerated the convictions of Dr. Small with regard to the parasitic nature of *M. phaseoli*. Dr. Small was very guarded in his first reports and advanced slowly to the view that

the fungus can attack healthy plants but he did not push his view to the extreme Dr. Briton-Jones might have led the Conference to believe. Positive evidence of the parasitic nature of the fungus on tea, coffee, and rubber were obtained before the speaker left Ceylon last year. He considered that Dr. Small's work had been of great value because it focussed the attention of mycologists in the tropics on a very definite problem.

Mr. South (Federated Malay States) gave an account of his experience of root diseases which attack rubber in Malaya. These could be classified into two groups (*a*) *Fomes lignosus* attacking young trees and (*b*) Fungi of various kinds (chiefly *Fomes pseudoferreus*, *Ustulina zonata*, *Sphaerostilbe repens*, and the not fully identified species causing brown root diseases) on older trees. He had had a large field experience of *Fomes lignosus* and cited an instance where the fungus attacked most of the trees of a two-year-old plantation of 50 acres and was so prevalent that, if one kicked the soil with one's foot, strands of *F. lignosus* were exposed. Under these conditions the fungus was undoubtedly parasitic. Both *F. lignosus* and *Rosellinia* spread in a circle. With regard to the second group, Mr. Belgrave had definitely established the parasitism of *Fomes pseudoferreus* by experiment. *Ustulina zonata* needed further investigation, whilst *Sphaerostilbe* usually developed in water-logged soils.

Dr. Gadd (Ceylon Tea Research Institute) stated that the original contention of Dr. Small that *R. bataticola* was the basic cause of all root disease in Ceylon meant that *Fomes lignosus* and other fungi were merely secondary and that control measures against these organisms was ill-advised. The good results attending such control measures, however, compelled him to protest against their abandonment. He considered that Dr. Briton-Jones had misinterpreted his views. He had not stated that control by trenching was a proof of parasitism; he had merely emphasized the success attained by this method of control. The speaker called attention to the absence of proof of the parasitism of *R. bataticola* but stated he had got positive results with *Rosellinia*. The tea plant undergoes severe treatment from plucking and pruning and this treatment appears to predispose the plant to attacks by *Diplodia*, the effects of which the speaker was inclined to think might have been confused with those attributed to *R. bataticola*. If pruning and plucking were the real cause of trouble, then control should be directed against these factors. Tea bushes in dry patches of shallow soil often bore both *R. bataticola* and *Diplodia*, but it was questionable whether the drought was the cause of the trouble or whether this was due to the fungi present.

Dr. Reichert (Palestine) gave an account of the root diseases of Palestine. In the seed-bed citrus is affected by a species of *Rhizoctonia* and in the orchard by stem, collar, and root rot, the exact causes of which are unknown. Vine roots suffer from Phthyriosis, an epidemic disease in which the roots are covered by a thick fungal layer under which *Pseudococcus vitis* is found. Apple and peach trees showed a root rot apparently caused by a species of *Rhizoctonia*, and *Carica papaya* by one due to a *Pythium*. Banana roots show a decay usually associated with nematodes, but the cause has not been determined. *R. bataticola* was first found in 1923 causing stalk rot of tobacco, but has now been recorded on 34 different hosts. Of special interest is the occurrence of this fungus on sweet lemon, causing a bark and root rot, and on garlic, sunflower, and maize, on which it lives saprophytically. *R. bataticola* is only able to attack plants when they are in an enfeebled condition, and the speaker suggested that it may be truly a saprophyte which by gradual adaptation is becoming parasitic.

Dr. Nattrass (Egypt) described his investigations of *Rosellinia necatrix*, the cause of a disease of fruit trees in England. He had no doubt about the parasitism of this fungus.

Dr. Gadd inquired whether *R. necatrix* was associated with any definite soil conditions.

Dr. Nattrass replied that the fungus was confined to the West of England, but no association with special soil conditions were observed.

Mr. F. E. V. Smith (Jamaica) stated that *Rosellinia* causes considerable trouble in Jamaica when there is excess of humus. The strongest trees were frequently those attacked.

Prof. Briton-Jones observed that Dr. Small had somewhat modified the opinion expressed in his earlier papers and now agreed that secondary factors were important in the parasitism of the fungus. With regard to the case of the death of tea bushes on shallow soil mentioned by Dr. Gadd, he thought that much could be done in the alleviation of drought, even in the tropics, by the addition of humus to the soil. The speaker emphasized the importance of the internal constitution of the plant as factor determining susceptibility to the fungus.

Mr. F. T. Brooks, in closing the discussion, mentioned that from his tropical experience he was fully persuaded of the evident parasitism of *Fomes lignosus* and *Ustulina zonata*.

Meeting: *Tuesday, 24th September*, 10.0 *a.m.*

Chair: Mr. F. A. Stockdale.

Discussion: **"The existing organisation of plant pathological (plant protection) services in various parts of the Empire."**

The Chairman, in introducing the subject for discussion, spoke of the progress made in plant protection legislation which is now generally recognised as necessary, and accepted by all growers as essential for the effective protection of their interests; in fact, growers themselves were now asking for regulations in advance of actual requirements. He warned the Conference against scheduling a disease until it had been shown that such a course was absolutely necessary. Trade interests should be met as far as possible. While certain regulatory provisions were common to all countries in the Empire, each country had found it essential to maintain an individuality of its own. In regard to tropical Colonies, provision should be made for prohibiting absolutely certain imports, for restricting others, for the right of specifying quarantine periods for imports, and for the right of inspection of all imports whether covered by certificates or not. Certificates were undoubtedly an additional safeguard, but at most they indicated that the plant material they covered was of a superior standard. No exporter of low grade products would take the trouble of securing certificates and hence would either deal in better produce or give up the trade. Certificates, however, could not be taken as an absolute guarantee against the transport of disease. With regard to the certification of new diseases, the speaker suggested that neighbouring countries in the same geographical area should arrange to keep each other informed of outbreaks of new diseases, whilst world-wide notification might be effected through the Imperial Bureau. In conclusion the speaker stressed the importance of education in the progress of disease control; police action in itself was ineffective, though legal powers were a great help for use against wilfully negligent or recalcitrant growers and also in the case of sudden outbreaks of disease.

Mr. Fryer (Ministry of Agriculture) considered that the disfavour into which health certificates had fallen was a result of misconception as to the meaning of such certificates. They were no guarantee of freedom from disease but merely meant that mass introduction of pests would be avoided. It was often said that certificates should be based on scientific considerations but economic ones were sometimes paramount; in the case of imports not grown in the importing country the regulations need be much less drastic than in others.

Dr. Güssow (Canada) referred to the unsuccessful attempt made at the International Phytopathological Conference in Holland to formulate a certificate acceptable to all countries. He thought that it would be very desirable if the British Empire could agree to a common certificate and this might then lead the way to an international one. In framing regulations against diseases much might be done to alleviate the irritation felt by exporting countries by consultation with the authorities and producers in those countries; as a result of conversations he had had with growers in Holland many modifications had been suggested to him which he was willing to include in his regulations. Too much importance should not be attached to a certificate, as it was humanly impossible to certify consignments absolutely free from disease. Common standards of grading of produce should be adopted by all countries

so that it would be possible to prevent the introduction of lower grades than the domestic ones. In framing legislation, diseases should not be specified by name, as Canadian experience had shown that when unspecified diseases came along they could not be dealt with. Finally the speaker emphasized the importance attaching to biologic forms of parasitic species already widely known, and cited the instance of a form of *Puccinia graminis* on oats from South Africa which threatened to ruin oat cultivation in Canada.

Dr. Butler said that the whole question of protection against disease depended (*a*) on a knowledge of the world distribution of the disease, (*b*) on a knowledge of the parasite. The distribution of any parasite of any major crop was important and the Empire was markedly deficient in such information though lists of diseases in various colonies were being prepared. He also advocated the study of diseases they were afraid of introducing in countries where they occurred, so that they would be in a position to deal with the disease should it be introduced. He endorsed the remarks of Dr. Güssow with regard to the introduction of fresh strains of parasites known already to occur in the country concerned and instanced the spread of *Tilletia levis* in U.S.A. The value of certificates was that they ensured to a certain extent the health of the crop in the exporting country, but they could never be regarded as an absolute guarantee of freedom from disease. The establishment of mutual confidence between countries was of fundamental importance and nothing could be more destructive than any attempt to conceal any outbreak of disease by any country. The introduction of certain necessary plants under permit had worked well in India ; only imports from firms of high repute being permitted entrance.

Dr. Murphy (Irish Free State) agreed that economic considerations were the limiting factor deciding quarantines in some cases, but this was not so in others ; and when scientific considerations were paramount, one might be bound to restrict imports severely. The reluctance of pathologists to sign some of the certificates demanded could be well understood. Absolute freedom from disease could not be ensured by certificates ; there was only one method of effecting that, viz., by quarantine stations.

Dr. Cunningham (New Zealand) mentioned that plant disease legislation in New Zealand was drawn up in 1892 and had no special reference to the probable economic importance of the diseases. The matter was now under revision. Attempts were now being made in New Zealand to eliminate certain potato diseases and it was impossible for them to let in any potatoes from any part of the world. The speaker stressed the importance of field inspection in certifying the health of plants. Kenya, on importing *Albizzia* seeds from New Zealand, had asked for a certificate of absolute freedom from disease and to comply with this they had examined the growing trees for diseases. They found a *Fusarium* which, as it rendered the pods absolutely worthless, was eliminated and the certificate required could be granted. Australia also had demanded that potatoes should be absolutely free from powdery scab (*Spongospora subterranea*). Merely by examining the tubers it was impossible to give such a certification, but by examining the potatoes in the field and permitting export only from certain districts it was possible to comply with the conditions.

Mr. Wortley (Nyasaland) agreed with Dr. Cunningham as to the importance of field inspection. They were desperately afraid in Nyasaland of importing pink boll worm on cotton, and hence cotton was only imported in small quantities and accompanied by a certificate stating that the disease did not occur in the country of origin and that the disease could not be found on the growing crop. The speaker attached great importance to developing strong public feeling regarding the danger run by insignificant irregular importations.

Mr. Dade (Gold Coast) also spoke of the danger arising from small imports and referred to the importation of pink boll worm into the Gold Coast, the spread of which was only prevented by the timely action of the entomologist. Police methods had failed to enforce internal plant disease regulations, and ultimately the scheme initiated for clearing up the cocoa plantations had to be abandoned as it would take 70 years to complete. The French colonies had, so far as he was aware, no total quarantine and he thought this state of affairs was a menace to the British West African Colonies.

Dr. Butler agreed that this matter was most serious and suggested that Mr. Stockdale be asked to bring the subject to the attention of the West African Agricultural Conference which he was attending.

Mr. Bunting (Gold Coast) seconded Dr. Butler's suggestion which was carried unanimously.

Mr. F. E. V. Smith (Jamaica) was strongly in favour of total prohibitions and mentioned the danger of the introduction of bunchy-top of bananas to Jamaica. In certain cases total prohibition was impossible and in Jamaica seed potatoes had to be certified whereas ware potatoes were not.

Dr. Butler mentioned the occurrence of a probable mosaic disease of bananas in the quarantine house at Kew and considered that far more use could be made of quarantine houses than at present.

Mr. Deighton (Sierra Leone) spoke af the total prohibition against maize on account of maize smut in Sierra Leone, though he was in doubt whether the quarantine was effective.

Mr. South (Malaya) stated that in a new country where new crops had to be established there was a great danger of the introduction of new diseases. In Malaya such danger existed, rice, fruit, and fresh vegetables being imported in such large quantities as to prevent effective inspection. Budded rubber was also being imported from Sumatra and Java and there was great difficulty in inspection; they had to rely on the certificates. It was impossible to exclude rubber from countries infected with *Oidium* as the supplies were so badly needed.

Dr. Gadd (Ceylon Tea Research Institute) thought that *Oidium* might have been introduced into Ceylon with bud wood. In the case of tea, he found that seed disinfection was practically useless against many fungi and, therefore, as *Exobasidium vexans* probably behaved in the same way, they prohibited all tea seed from India from entry into Ceylon.

Mr. Stockdale (Ceylon) thought that *Oidium* on rubber had not been introduced with bud wood from Java. He supported Dr. Butler's suggestion that the bud wood might be disinfected against *Oidium* before despatch.

Mr. Freeman (Trinidad) stated that in Trinidad wide powers of prohibiting imports were given to the Department of Agriculture, who allowed entry of necessary material by permits. He endorsed the necessity of educational work.

Prof. Briton-Jones (Imperial College of Tropical Agriculture, Trinidad) emphasized the importance of treating the planter sympathetically; legislative powers should be used with great reluctance.

Major Archibald (Sudan) stated that the League of Nations was assisting countries regarding medical quarantines and he thought that the same body might be able to help in mycological questions.

Dr. Pethybridge attached great importance to certificates being given in good faith. Standardisation of grading was necessary and the time was approaching when grading would take cognisance of pathological questions. The terms used for the grades should not be misleading.

Mr. Stockdale suggested that further discussion should be postponed until Wednesday afternoon and this was agreed to by the Conference.

Meeting: *Tuesday, 24th September*, 2.30 *p.m.*

Chair: Dr. G. H. Pethybridge.

Discussion: **"Field inspection and certification of crops as a basis for the prevention of disease."**

Dr. Güssow (Canada), in opening the discussion, described in detail the certification of seed potatoes in the Dominion of Canada. In 1920 about 1 per cent. of the total crop was inspected, in 1928 about 6 per cent. The primary object of the certification was the reduction of potato diseases in Canada, but the certified seed had given such good results that large quantities of seed potatoes are now exported

regularly to the United States. Difficulty has been experienced in the use of fraudulent tags; growers' tags were permitted in addition to the Government tags if desired. Canada had the great advantage over the United States in that the standard was uniform throughout the Dominion, whereas in the United States it varied from State to State. Comparative trials of Canadian potatoes in New Jersey with United States potatoes had recently been carried out with very satisfactory results. Of late years there had been a tendency to limit the varieties grown to the Irish Cobbler and Green Mountain with the result that difficulty was being experienced in supplying seed of certain varieties to Bermuda and other places. In addition to potatoes, raspberries were now being subjected to inspection and certification, and this service, inaugurated in 1926, was already proving of great value to the industry. Flowering bulbs imported into Canada from Holland were found to be diseased and the Canadian authorities had to reject 80,000 to 200,000. Field inspection of flowering bulbs had now been started and promised to prove of great assistance to bulb growers.

Mr. Anderson (Scottish Ministry of Agriculture Seed Testing Station) described the organization for the certification of seed potatoes in Scotland. It was started in 1919 primarily for certifying the purity of immune varieties, but traders had since asked for non-immune varieties to be included in the scheme. The Department of Agriculture was now examining 60,000 acres of potatoes annually. The inspectors were trained in pairs—an experienced man working with a junior so that a steady flow of trained recruits to the service was maintained. An attempt was now being made to produce high-class seed stocks by unit selection. The seed stock certificate required freedom from blackleg (*Bacillus atrosepticus*), virus diseases, corky scab (*Spongospora subterranea*) and blight (*Phytophthora infestans*). The speaker mentioned incidentally that one early variety from the Channel Islands owed its early ripening quality to virus disease infection.

Dr. Murphy (Irish Free State) gave an account of the certification service in the Irish Free State. The service was under the direction of Mr. Davidson who had 22 permanent inspectors working under him. Inspection was made in the field and again when the tubers were bagged. Practically all varieties were infected with virus diseases which could frequently be manifested only by testing on other varieties. It was quite possible to obtain fields free from visible virus diseases, but if something better than this were required the difficulties were very great. No leaf roll crop was certified in Ireland.

Dr. Cunningham (New Zealand) said that potato certification had started in New Zealand about five years ago as the yield had fallen from 8 tons to between 2 and 2½ tons per acre. The standards at first were very low but these had been gradually raised. Two years ago the Plant Research Station was established for the production of disease-free crops. Potatoes from England, Scotland and Ireland all gave mild mosaic in New Zealand but were relatively free from other diseases and were used as a basis for seed stocks. Certification of barley, against loose and covered smut (*Ustilago nuda* and *U. hordei*) had been satisfactorily established, largely through the instrumentality of the combine controlling the production of malt in New Zealand. Incidentally it had been found that the production of malt extract from the smut free seed was higher than anywhere else. They also had 2,000 acres of wheat free from bunt (*Tilletia caries* and *T. foetens*) and loose smut (*U. tritici*) and about 200 acres of oats free from smut. Bud certification of fruit trees was being established, bud wood being taken from only certain selected trees, and in this way it was hoped to build up a more uniform type of produce.

Mr. Fryer (Ministry of Agriculture) mentioned briefly the certification of healthy stocks of strawberries and black currants in Great Britain. He wished to know whether the cost of certification in Canada and elsewhere was borne by the Government or by the growers.

Mr. Anderson explained that in Scotland a charge was made for certification and this more than covered the cost.

Mr. Ogilvie (Long Ashton Research Station) spoke of the inspection of lily bulbs in Bermuda.

Mr. Wortley (Nyasaland) stated he had started certification of tobacco in Nyasaland.

Dr. Pethybridge (Ministry of Agriculture) spoke of the success attending the certification of potatoes in England and remarked that *Colletotrichum atramentarium* sometimes produced symtoms very like primary leaf roll.

Dr. Güssow, in conclusion, stated that a barrier of turnips two drills wide round healthy potato plots was not nearly enough in Canada where at least 150 feet was required. In the Dominion the entire cost of certification was borne by the Government, and though the question of making a charge was now under consideration again, it had hitherto always been postponed.

Meeting: *Wednesday, 25th September*, 10.0 *a.m.*

Chair: Professor V. H. Blackman.

Discussion: **"Virus diseases."**

Dr. Murphy (Irish Free State) gave an account of his work on the virus diseases of the potato. The original view that there was only one mosaic disease gave way in time to the general recognition of a number of distinct diseases, but more recently evidence of instability, if not indeed transmutation, of a virus had been obtained, though the theory of separate diseases still had much in its favour. A comparison of American diseases with those of the British Isles was complicated by the fact that the American material was contaminated with so-called streak, but tests on Green Mountain potatoes showed that leaf roll, Aucuba mosaic, interveinal mosaic, streak (probably) and witches' broom are the same in both countries, while mild mosaic in America corresponded probably to our crinkle. It was not certain whether the American rugose mosaic, spindle tuber, giant hill, yellow top, and yellow dwarf corresponded to any of our virus diseases or not. On certain varieties, the diseases differentiated themselves quite easily and had remained constant over a period of eight years. Picking out any one of these mosaic diseases as it appeared on Irish Chieftain, it might have a totally different appearance on other varieties, though it was known that the disease was the same by its behaviour when recovered on a standard variety. There were, however, apparent exceptions to this, e.g., Kerr's Pink reacted to infection by crinkle at first, but the plants afterwards showed no symptoms and crinkle had not been recovered from them; instead an almost imperceptible disease resembling simple mosaic had resulted. This work, already carried out twice, was now being repeated. Observations extending over seven years showed that the changes connected with the ageing of potato varieties were the effects of increasing amounts of virus infection, principally, if not entirely, mosaic. Most varieties were virus free at first, as infection of true seed is rare, but once vegetative propagation began virus infection increased with the inevitable reduction in yield accompanied by earlier maturity, often by improved cooking quality, and by increased susceptibility to *Phytophthora infestans*. It had been found possible to restore varieties to their pristine vigour by raising disease-free stocks. The greater the reaction of a variety to virus infection the greater was the reduction in yield. There were varieties which showed little or no effect even when most mosaic diseases were present and that might be regarded as carriers. In the study of virus diseases it was absolutely necessary to work with virus-free plants and the Irish Chieftain had proved most satisfactory as an indicator plant on which to test suspected stock. Considerable quantities of disease free stocks of potatoes available in Ireland had now been developed from original stock tested and found to be free from disease. The virus disease most commonly carried was streak, which was almost universally present in Up-to-Date. The American varieties Green Mountain and Irish Cobbler carried it as easily as Up-to-Date and it was the same disease which Johnston transmitted from apparently healthy potatoes to tobacco as ring spot. With regard to the vectors of leaf roll, *Myzus persicae* had been found to transmit the disease in 76 per cent. of cases, *M. pseudosolani* in 5 per cent.; *Macrosiphum solanifolii* in 0.66 per cent., and unidentified aphids in 15 per cent. Experiments with *M. persicae* showed that the age

of the inoculated plant was of importance in relation to the development of symptoms; when older plants were inoculated no symptoms developed in the current year and only secondary leaf roll in the following season. The absence of primary leaf roll in America might be due to late infection or it might be that their varieties were not so prone as ours to show primary leaf roll symptoms.

Dr. K. M. Smith (Potato Virus Research Station, Cambridge) prefaced his description of the work on viruses which he was carrying out at the Potato Virus Research Station, Cambridge, by a brief reference to the work of Dr. Salaman, the Director of the Station. Dr. Salaman isolated in 1927 a second form of crinkle which could only be differentiated from the first by its different reaction on various varieties. It had become very clear that the commoner form of crinkle when introduced into most varieties by means of needle inoculation produced a mosaic amd not a crinkle, but that when the introduction was by grafting, the result was a crinkle. There was also increasing evidence that the mosaic so produced, though indistinguishable from mosaics otherwise derived, was occasioned by a different virus. The main evidence for this lies in the differential reaction on *Datura*. The Station was also endeavouring to build up virus free stocks of the chief commercial varieties with a view to placing them at the disposal of the farmer, and the results of this work were extremely promising.

With regard to Dr. Smith's own studies he had found that the virus of interveinal mosaic of the variety President when transferred to Arran Victory or Great Scot produced interveinal mosaic plus streak. On tobacco, needle inoculation with the same virus from President produced double concentric rings, and needle transference back to President resulted in interveinal mosaic with streak lesions and crinkling. Passage through successive tobacco plants increased its virulence and inoculation of such a virus on President yielded merely a severe streak, the degree of virulence corresponding to the number of transfers through tobacco.

Passage of the crinkle from Myatt's Ashleaf through tobacco to potato produced a violent crinkle and leaf-drop streak in many varieties which showed no such symptoms when inoculated with the original virus. Transference of Myatt's Ashleaf crinkle by *Myzus persicae* to tobacco resulted in faint green lines as compared with severe necrosis from needle inoculation with the same virus. If the faint green lines virus were returned to potato, crinkle and leaf-drop streak were produced. Moreover, it was found possible to infect certain potato varieties through *M. persicae* after the insect had first carried infection to tobacco, whilst direct transference to the potato failed. This showed that tobacco was an almost symptomless carrier of crinkle and leaf-drop streak when transferred by *M. persicae*, and that such diseases were easily transmitted back to potato. Tobacco and potato crops should not, therefore, be grown in proximity. The weed *Solanum nigrum* at Cambridge had also been found an almost symptomless carrier of crinkle and leaf-drop streak. A ring-spot virus of *Solanum capsicastrum* produced a ring spot on tobacco and was thought to be the same virus as attacked tobacco in the field. It was identical in some phases with the ring spot produced in tobacco by needle inoculations with potato mosaic. Extensive experiments with *M. persicae*, the only insect transmitting leaf roll that he had found, showed that a non-infective aphis would pick up the virus after 6 hours' feeding on a diseased plant and that an infective aphis would infect a healthy potato plant after two hours' feeding. A non-infective aphis, however, could not pick up the virus and infect a healthy plant in less than 54 hours. Hence there was a short period before the insect became infective, but it was doubtful whether this was a real incubation period or whether it merely represented the time taken for the virus to circulate in the insect.

Dr. Henderson Smith (Rothamsted) described in detail his cytological study of the intracellular bodies associated with tobacco mosaic. These bodies were found in the cells of hairs, near the nucleus, and close to the basal wall of the cell, and they also occurred in cells of the leaf tissues. In some cells crystalline spike-like structures were apparent. Crystalline bodies were also observed to crystallize out from the intracellular bodies. The intracellular bodies originated as small plastic fragments which travelled round the cell in the cytoplasmic stream and came together at points where the strands of cytoplasm met, usually aggregating near the nucleus. At times,

parts of these aggregated bodies broke off and journeyed round the cell, then coming back again to the original body, which sometimes had a vacuolated appearance. There was no evidence of pseudopodia or true fission.

Mr. Massey (Sudan) gave an account of the serious and wide-spread outbreaks of leaf curl of cotton in the Sudan (where the disease was first observed on occasional plants in 1924–25) which corresponded exactly with the disease described by Jones and Mason from Nigeria in 1926. Every effort to transmit the disease except by grafting and budding failed, though its very rapid spread could only be due to an insect—probably a jassid.

Miss Cayley (John Innes Horticultural Research Station) described the latest results of her work on the breaking of tulips. Successful transmission of the disease had been secured in 56 per cent. of cases by *Macrosiphum gei* and 25 per cent. by *Myzus persicae*. Ignoring plants which did not flower, 77.7 to 92 per cent. successful inoculations were obtained by grafting.

Mr. Ogilvie (Long Ashton) described his work on the rosette and mosaic diseases of lilies in Bermuda.

Mr. Freeman (Trinidad) reported the success attending their efforts at the contro of sugar-cane mosaic in Trinidad. In 1920–21, of 104,000 stools examined, 8,000 were found infected and destroyed, but by 1927–28 only eight diseased stools were discovered out of 172,000 examined. *Aphis maidis* was not prevalent in Trinidad and the disease was evidently spread by cuttings. The cost of control at the start was 11*s*. 6*d*. per acre per annum and this was now 3*s*. 11*d*. per acre and in future there was a possibility of reducing it to as little as 2*s*. per acre.

Mr. Williams (Amani) mentioned in connection with the sugar-cane mosaic control in Trinidad that it was easier to dig up stools in the dry season than in the wet season. Forty stools recently infected were cut down and showed only about 50 per cent. infection in the sprouts—presumably because the virus had not had time to travel down the stem.

Mr. Ashby (British Guiana) stated that mosaic disease of sugar-cane had not yet occurred in British Guiana. Its absence was believed to be due to the policy of the former Director of Agriculture in refusing to permit the introduction of sugar-cane varieties from without, as the seedling D. 625 raised by him proved very suitable to the special conditions of the industry and was still the standard cane.

Dr. Butler referred to the work of McKay in Oregon on breaking of tulips, the earliest references to which dated from about the middle of the 17th century, constituting probably the earliest record of a virus disease.

Mr. F. E. V. Smith (Jamaica) spoke of the control of sugar-cane mosaic in Jamaica, and briefly described a mosaic of papaw occurring in that island.

Prof. Briton-Jones (Trinidad) referred to the symptoms on the strawberry produced by aphids, and criticized the tendency to attribute diseases to virus infection without sufficient proof.

Dr. Pethybridge (Ministry of Agriculture) gave a short talk on the organization and work of the Virus Diseases of Plants Committee.

Meeting: *Wednesday, 25th September*, 2.30 *p.m.*

Chair: Mr. F. A. Stockdale.

Arising out of the discussion on Tuesday morning, the following resolutions were put before the Conference and passed unanimously: No. 5, proposed by Mr. South, No. 6 by Professor Briton-Jones, Nos. 7 and 7a by Dr. Güssow.

Dr. Butler then desired to obtain the opinion of the Conference regarding certain matters arising out of the International Convention of Rome, 1929, particularly whether the Conference thought it desirable that, in the event of disagreement regarding the health of certificated plants, appeal should be made to an international tribunal. After some discussion in which Mr. Stockdale, Dr. Pethybridge and Dr. Güssow took part, it was decided that no action should be taken by the Conference in the matter.

Discussion : **"Practical difficulties in the administration of plant protection regulations and the possibility of laying down a standard minimum requirement for preventing the importation of diseased plant material."**

Mr. South (Malaya) opened the subject by giving an account of the working of the plant protection regulations in Malaya. The Plant Protection Service was started in 1913 and at present they had a staff of ten Agricultural Officers (European) to supervise the work of plant disease control. It was necessary for officers to work in sympathy with the headmen of the villages. One of their difficulties was the native-owned holdings on which trees were very closely planted and control measures frequently not observed. Whilst the Agricultural Officers did not really act as police, they had found it better to prosecute if control measures were not carried out rather than to take the work in hand themselves. No pressure could be put on any class of the community unless that class understood the symptoms and treatment of the disease in question. Great trouble had been experienced in tracing delinquents, and the register of landowners had been found extremely useful in this matter. In the event of the owner or occupier (both of whom were responsible for control measures being carried out) not being found, it was possible to serve a notice by posting it on the land. The dissemination of disease by migratory native labour had also proved a difficulty which had not yet been solved. Then with regard to the importation of plants, the long coastline of Malaya and the nearness of Sumatra made it almost impossible to prevent smuggling. There were, besides, two non-federated States without any Department of Agriculture, and these constituted a danger. Large imports of rice were regularly made and could not be interfered with, as rice is a staple article of food. Fruit and vegetables also were imported in some quantity, but the Department hoped to be able to deal with this matter in the near future. In attempting to exclude diseases one felt the lack of published records of diseases in certain countries, especially some of their neighbours. With regard to certificates, he emphasized the fact that these were sometimes not really necessary. The position of inspectors was not satisfactory, as only samples of consignments could possibly be inspected. Finally he raised the question whether a standard minimum treatment could not be laid down for the treatment of material for export from any country. He instanced the success of turpentine fumigation against coffee berry borer and thought that other standard control measures could be worked out.

Mr. Stockdale (speaking for Ceylon) mentioned the unsatisfactory position of export consignments for inspection purposes. Samples might be submitted, but there was nothing to ensure that consignments are up to standard. With regard to a minimum standard treatment, the speaker referred to Ceylon's effort to help India in her fight against pink boll worm by agreeing to enforced treatment at Bombay. There were, however, certain diseases which could not be excluded by any minimum standard treatment.

Prof. Briton-Jones (Trinidad) was of opinion that there was no standard treatment which would control all the diseases on a crop in the tropics. He agreed with the proposal in principle, but each case would have to be judged on its merits. He would support any suggestion for co-operation in this matter, not only as regards planting material but also as regards food products.

Dr. Butler understood the suggestion of the Malayan representatives to mean that investigation of certain specific diseases should be made with a view to working out a standard minimum treatment, and thought that a resolution on these lines might be accepted.

Mr. Stockdale considered that there was a danger that the standard minimum treatment would induce a country to permit which might prove undesirable.

Mr. Freeman (Trinidad) spoke of the disadvantage of having stereotyped regulations specified in legislation. He was strongly of opinion that it was better to leave in the hands of the Director of Agriculture in a Colony power to refuse permission if he thought fit, and stressed the desirability of plant disease ordinances being made as flexible as possible. In Trinidad, if a planter refused to carry out necessary control

measures, the work was done and the planter charged with the cost, which constituted a first charge on the estate, and which, if not paid, could be recovered by the issue of a distress warrant. The plan worked very well in practice and avoided action in the courts.

After some further discussion, Mr. South proposed Resolution 8, which was seconded by Professor Briton-Jones and passed by a small majority, most of the members of the Conference abstaining from voting.

Meeting: *Thursday, 26th September*, 10.0 *a.m.*

Chair: Professor H. H. Dixon.

Discussion: **"Seed-borne diseases, with special reference to (*a*) standard methods of determining percentage infection, (*b*) standard methods of seed treatment, (*c*) legislation governing the export and import of seeds."**

Dr. Cunningham (New Zealand) introduced the subject by emphasizing the importance of seed-borne diseases to New Zealand and the necessity of establishing stocks of disease-free seed for the control of these diseases in that country. The only way they had found of doing this was to grow their own seed and they had at present 11,000 acres of barley free from loose smut (*Ustilago nuda*) and also considerable areas of wheat which was absolutely free from loose smut (*U. tritici*) and bunt (*Tilletia*). These attempts had met with signal success and promised to be of immense importance in disease control. A big problem in New Zealand was the dry rot of swedes, which might cause a loss of from 30 to 80 per cent. of the crop. The effect of this disease had been to reduce the acreage to one-fifth of what it was twenty years ago. It had been found that a very small proportion of the seed (2 to 5 per 1,000) might be infected by the causal organism, *Phoma lingam*, and doubt had been expressed whether such a small percentage of infection could give rise to an epidemic. To establish this point the spread of the disease on certain virgin land in New Zealand had been watched very carefully and plotted on charts, and it was found that the disease originated on six plants only, from which it spread in circular areas and then epidemically. The author stressed the rapidity of spread of the disease, which might be accounted for by the fact that a certain midge, occurring in New Zealand turnip fields, was attracted by the mucilaginous exudate from the pycnidia of the pathogen. It had been suggested that the fungus may overwinter in the soil as in England but no increase of infection was obtained by growing turnips on infected land. The speaker did not now insist on the pathogenicity of his strain Ia, described in his *Bulletin* on the subject, but stated that strain IIa is very virulent to seedlings. The problem in New Zealand was to obtain disease-free seed. Disinfection of the seed gave good results in the laboratory but not in the field and the only method of obtaining non-infected seed was from disease-free plants. In Britain, where most of the New Zealand seed was grown, dry rot had been found to be invariably present. Another seed-borne disease in New Zealand was the collar rot of peas (*Ascochyta pisi*) for which no disinfection treatment was yet effective, and the possibility of control by means of disease-free seed was now being investigated.

Dr. Murphy (Irish Free State) stated that dry rot of swedes was serious in Ireland but he thought only about one quarter as abundant as in New Zealand. He agreed that English seed was infected with Dr. Cunningham's IIa strain of *Phoma lingam* but in extremely small amounts, and he still doubted whether an infection of 2 in 1,000 was enough to cause serious damage. Field symptoms in Ireland were practically identical with those in New Zealand, the infection centres being well defined. It was an interesting problem to know what happened to the fungus between seed sowing and the appearance of the disease in August; a considerable proportion of infected seedlings were eliminated in the process of thinning. Dry rot was undoubtedly capable of being contracted from seed and from soil.

Dr. Pethybridge (Ministry of Agriculture) was of opinion that we ought not to conclude too readily that diseases were seed-borne. Absolute proof was necessary before one could go to seed raisers to get things altered, and very big interests were

involved in this trade. Circumstantial evidence might be strong but that alone was not sufficient. The speaker mentioned the difficulties of determining infection when it amounted to only about 4 seeds per 1,000 and stated that Dr. Cunningham's strain IIA was the only strain found parasitic in this country. It was puzzling that the disease was so much more serious in New Zealand than in England ; there must be some special conditions involved, of which the occurrence of the midge mentioned was probably very important.

Mr. Eastham (National Institute of Agricultural Botany Seed Testing Station) said that the question of seed-borne diseases was a very important one. Farmers bought seed of good quality but the subsequent crop failed and enquiries were then made to the Seed Testing Station for the cause of the failure. Sometimes they were able to discover fungous parasites. He thought that it might be possible for the Seed Testing Stations to be able to give more information, if desired, provided that international co-operation could be secured in the matter.

Dr. Gussow (Canada) stated that seed-borne diseases were of great importance in Canada, those especially on wheat.

Dr. Butler asked whether anyone knew of a seed-testing station which included a mycologist on the staff, and called attention to the importance of this omission.

Prof. Westerdijk said that the Seed Testing Station at Wageningen included a mycologist on its staff.

Mr. Mercer (Northern Ireland) thought that the International Seed Testing Station Association might be approached with regard to the matter of seed-borne diseases. He was of opinion that the seed-testing station should work in close co-operation with a pathological department.

Dr. Güssow favoured closer co-operation between the seed-testing station and the plant pathological station rather than the appointment of plant pathologists to seed-testing stations.

Dr. Cunningham agreed with Dr. Güssow and instanced the successful co-operation of this nature in the Department of Agriculture in New Zealand.

After further discussion, Dr. Güssow proposed Resolution No. 9, which was seconded by Dr. Murphy and passed unanimously.

Discussion : **"Organization of spray services based on weather predictions."**

Mr. Wiltshire opened the discussion with an account of the spray warning service against potato blight (*Phytophthora infestans*) instituted in 1928 in Holland. The work of Professor van Everdingen on which the service was based was described and the four conditions found to precede outbreaks of blight explained in detail. The issue of warnings to the public were made (*a*) by notification on the daily weather report of the Dutch Meteorological Institute and (*b*) directly to farmers through Press reports, etc., by the Phytopathological Service. The working of the service during 1928 and 1929 was described. A comparative examination was made of English data regarding outbreaks of potato blight and it was found that the results of the Dutch workers were confirmed to the extent that before an outbreak of blight occurs the four conditions of van Everdingen more or less exactly obtained in the great majority of cases, though a number of days occurred which fulfilled these conditions but which were not followed by blight. In conclusion the speaker referred to the important correlation of rainfall and temperature in relation to potato blight established in the United States, and made some general remarks regarding the inadequacy of mycological data in regard to outbreaks of blight and the lines upon which further research was required.

Dr. Güssow (Canada) gave a detailed account of the system of advising the spraying of fruit trees in Ontario and other parts of Eastern Canada as a result of the weather forecasts received by the Dominion Botanist from the Meteorological Department. Taking as a specific example, the spraying of apple trees against scab (*Venturia inaequalis*), the speaker referred to the detailed studies made on the seasonal development of the fungus, in particular on the effect of weather conditions on the time of ascospore discharge. On the basis of these studies spray warnings were issued by circular or telephone when meteorological conditions indicated the probability of early infection. A service of this nature was organised from the St. Catherine's

Plant Pathology Laboratory, Ontario, and had proved conclusively that such a service was of great value to the fruit grower, enabling him to secure improved protection from the disease and to produce fruit of better quality. Spray warnings were also issued against cherry leaf spot (*Coccomyces hiemalis*) and had given very good results.

Dr. Murphy (Irish Free State) gave an account of the relation between the weather and potato blight in Ireland in which he showed that, while temperature was of little importance, rainfall at a certain period of the year appeared to have a decided significance. From data presented in tabular and graphic form he deduced that a figure could be obtained, by taking the total rainfall in June added to half that in July and one third that in May, below which blight was mild and above which it tended to be severe. This figure was somewhere in the neighbourhood of 190 mm.

Mr. Corless (Meteorological Office, Air Ministry) explained that the meteorological records were made from instruments in the ordinary screen, about 5 feet from the ground, and that considerable variation might be experienced at times between these records and the conditions near the soil. The method adopted in estimating the period of dew formation was described and the degree of accuracy attaching to such an estimation indicated.

Dr. Pethybridge (Ministry of Agriculture) was surprised to hear that temperature had such relatively little significance in potato blight outbreaks in Ireland as suggested by Dr. Murphy's work, and cited a season in which a cold summer even with considerable rainfall apparently led to little blight, though there was much *Botrytis*. He also emphasized the necessity of fuller information than the bare record of outbreaks of blight reported by observers.

Dr. Butler described the organization of the Montpellier Station in the south of France for the issue of spray warnings against vine mildew (*Plasmopara viticola*). Throughout this region, observation posts reported each Monday on the weather conditions of the preceding week to the central station, and during critical periods falls of rain might be notified by telegraph. The conditions governing the germination of oospores, the resulting infection of the young leaves, and the production of the first crop of sporangia, had been worked out in detail. After infection was once established in the vineyard it only required a combination of heavy rain, high winds, and suitable temperature to produce a further wave of disease. A close watch was kept for the germination of the oospores in the experimental vineyards and warning to give the first spray was given about a week after this occurred. Thereafter, warnings were given when conditions were favourable for a fresh wave of infection. Information when to spray was disseminated by code telegrams, telephones, and all sorts of means, including heliographs, bell signals, etc. During 1929 the rains at the normal time of oospore germination were so light in the south of France that this did not occur. These conditions persisted, so that only two warnings to spray, each restricted to specified districts, were issued up to 11th September, an almost unheard of experience, and the saving in copper sulphate and labour must have been very great indeed.

Meeting: *Thursday, 26th September*, 2.30 *p.m.*

Chair: Professor H. H. Dixon.

Discussion: **"Epidemiology of common and widespread diseases in cereals, including rusts and smuts."**

Dr. Güssow (Canada) gave a résumé of the studies made on rust epidemiology in Western Canada. The average annual loss during the last fifteen years had been conservatively estimated at £5,000,000, the heaviest damage occurring in Manitoba and Saskatchewan, whilst at Alberta the loss had been slight. Germination tests had shown that, although a small percentage of uredospores remained viable till the 1st May, they had never been known to persist long enough to infect the new crop and as a means of propagating the disease could be considered negligible. In years

when wheat was stacked, the threshing of heavily rusted grain in the spring had only been found to result in a limited number of infections, if indeed any, from this source. Infection from barberry was no longer a significant factor in rust epidemics, the eradication of the shrub in the prairie provinces having been completed by 1924. There remained a third way by which infection may arise, namely, by wind-blown spores. It had repeatedly been observed that rust infections appeared first in Southern Manitoba and South-eastern Saskatchewan and that there appeared to be a progressive advance northward through Iowa, Minnesota, South Dakota, and North Dakota into Canada and then north and westward. Circumstantially, therefore, the inoculum which caused the earliest rust infections in Canada was carried in from adjacent territory lying south by air currents. Slides exposed in spore traps at various places in Western Canada had shown that rust spores occurred in southern Manitoba and Saskatchewan two to three weeks earlier than any trace of rust could be found in the fields, and the evidence indicated that, until infection became widespread, the bulk of the inoculum was carried northward from the States lying just to the south, where the development of rust had reached its maximum before the disease had made much headway in Canada. Rust spores in Alberta were detected from three to four weeks later than in southern Manitoba, the prevalence of westerly winds probably accounting for this belated arrival. It thus happened that the wheat crop of Alberta was usually too far advanced to suffer loss from this source. Additional evidence of the northward movement of rust spores in air currents had been secured by the exposure of glass slides during aeroplane flights. Rust spores had been detected in the air over regions remote from any rust-infected area and the conclusion was that they must have been transported there by air currents.

Dr. Reichert (Palestine) gave an account of the work he was doing on the resistance of wheat varieties to bunt in Palestine. Strains of *Tilletia tritici* from various sources were tested on a number of wheat varieties in order to compare their virulence with the Palestine strain of bunt. All the wheat varieties tested remained immune from the latter. The resistance of the varieties Florence and Bunyip to Palestine bunt was broken down by three foreign strains of bunt. Three definite strains of *T. tritici* were identified, (*a*) the Palestine strain which was weakly pathogenic, (*b*) the Breslau and Cosel (Germany) strain which was very virulent, and (*c*) the Danish, Swedish and Welsh strain, which exhibited medium virulence. Martin wheat remained immune from all strains of bunt tested.

Mr. Dillon-Weston (Cambridge) described the investigations he had carried out by aeroplane on the spore content of the upper air. Disease organisms were found to be ubiquitous ; spores were obtained up to about two miles and bacteria occurred even higher than this. Clouds were more heavily charged with spores than the adjacent atmosphere. With regard to the spread of disease from one country to another, the speaker stated that a spore liberated at a height of 8 ft. would travel two miles in a 30 m.p.h. wind before alighting on the ground. But while spores might be carried long distances in the air, it did not follow that epidemics would develop from such transference, as the environmental conditions might not be right for these to take place. In connexion with Dr. Reichert's work on bunt, the speaker thought there were many more strains than those mentioned. Shearman wheat inoculated with Little Joss bunt gave only a trace of infection, but with its own bunt, obtained originally from Little Joss, gave 89 per cent. infection. Ridit similarly gave a trace and 14 per cent., Hussar a trace and 18 per cent. It seemed, therefore, that Little Joss bunt was a mixture from which one could separate out strains virulent to a particular host in the same way as the plant breeder could breed a variety resistant to a given disease.

Miss Sampson (Aberystwyth) had found in her work on the oat smuts that there was scarcely evidence of real immunity as, under very favourable conditions, a small percentage of infection occurred. She had isolated three strains of *Ustilago avenae* which differed markedly in their reaction to Potato Oats, *Avena nuda*, and *A. strigosa* (certain lines) and three of *U. levis* which differed in their pathogenicity to *A. strigosa* (certain lines), *A. brevis*, and Potato Oats.

Dr. Cunningham (New Zealand) agreed with Mr. Dillon-Weston that there are probably many more strains of bunt than those separated out. The speaker referred

to the work of Dr. Stakman who had determined 63 physiologic forms of *Puccinia graminis tritici* and now found that hybridization occurs between these.

Dr. Güssow stated that 52 biological forms had been identified in Canada of which only a very few differed from those in U.S.A. Spores collected by aeroplane at 10,000 ft. were nearly all rust spores and gave 92 per cent. germination. After rainfall the air was found to be comparatively free from spores.

Mr. Wortley (Nyasaland) said that the present discussion and that of the morning session emphasized the importance of the study of meteorology in connexion with plant diseases, and considered that such information would be particularly valuable to a tropical country.

Dr. Güssow agreed with Mr. Wortley, and undertook to draft a resolution expressing the sense of the Conference on this matter for submission at the concluding session.

Prof. Westerdijk (Baarn, Holland) gave an account of the work of the Centraalbureau voor Schimmelcultures founded in connexion with the Association Internationale des Botanistes in 1905 to 1907. It began as an international body and became fully Dutch on account of the war, which resulted in the dissolution of the Association Internationale. It was then financed for a time solely by Dutch botanists, but later was aided by the Dutch Government. It is now incorporated in the Phytopathologische Laboratorium Willie Commelin Scholten under Professor Westerdijk's direction. The collection included 2,400 species of fungi and about 85 different media were used. The cultures were kept in an unheated room but very low temperatures were not favoured. It was usual to subculture three times a year, but about 800 cultures had to be transferred six times a year lest they should die out. About 100 to 1,200 cultures were distributed each year. A card index of all the cultures was kept and all data concerning them and the diet used was carefully entered. Each transfer was made to two tubes of different media and the next transfer to two tubes of new media. Some attempt was made to record the literature of diagnoses, and of icones on the index cards. The work had been hampered during recent years by lack of funds, but a new scheme whereby individuals or institutions could pay a fee of £2 10*s.* 0*d.* or £5 0*s.* 0*d.* entitling them to 50 cultures per annum or as many cultures as they required, respectively, free of further cost, was now being put in operation, from which a more settled income would be assured. The co-operation of mycologists was sought both as regards the sending of cultures to be incorporated in the collection and financially.

Meeting: *Friday, 27th September,* 10.0 *a.m.*

Chair: Professor V. H. Blackman.

Discussion: **"Diseases developed in fruit shipped overseas, including bitter pit and storage troubles."**

Dr. Barker (Low Temperature Research Station) stated that a survey of diseases occurring in fruit shipped from overseas was started in 1926 and as a result of this study the main forms of wastage in imported fruit were now known. Investigations on the control of such wastage followed two main lines (*a*) methods by which prevention could be effected, (*b*) the application of such methods to practice. Wastage in imported apples was largely caused by bitter pit and internal breakdown, the symptoms of which were described. The time of picking had a marked effect on the incidence of bitter pit—immature fruit was much more heavily attacked than mature—and later picking of Australian shipments would undoubtedly reduce the loss from this disease. Internal breakdown was observed in apples from all exporting countries, especially Australia and British Columbia. Two types of internal breakdown had now been recognised, the low temperature type, which was controlled by storage at 38° F., and inherent internal breakdown or Jonathan breakdown as it occurred in the British Columbian fruit. The flesh collapse of New Zealand was the

same as the low temperature internal breakdown. In conclusion, the nature of the disturbances of metabolism resulting in the development of bitter pit and internal breakdown was briefly discussed.

Mr. Tompkins (Low Temperature Research Station), dealing with fungal rotting of fruit in storage and transport, expressed the opinion that the producer tends to allow his interest in the crop to end with its production, and crop mycologists are inclined to adopt the same limited outlook, though both should consider the ultimate disposal of the crop in distant parts of the world. As regards fruit sanitation, it was not enough to keep fruit clean in the orchard ; it must also be kept sound until the time of consumption. The problem of storage was to prevent or delay infection and to retard subsequent spread, and the way this might best be done would vary with the time and method of infection—points on which there was yet no very definite information, except that the importance of surface injuries seemed clearly appreciated. In the control of fungal rotting three main avenues of approach were open : (1) by rapid cooling of the fruit in order to retard the early stages of infection ; (2) by the use of fungicides either in the orchard or directly on the fruit itself (e.g., borax on citrus) ; and (3) by modifying the atmosphere of the store (*a*) by introducing carbon-dioxide or, in the case of grapes in U.S.A., sulphur dioxide ; or (*b*) by reducing humidity, which affected only the early stages of infection, as once the rot was established atmospheric humidity could have very little effect.

Dr. Cunningham (New Zealand) expressed his appreciation of the work of the Low Temperature Research Station in assisting overseas workers in solving their fruit storage problems. With reference to picking the fruit at exactly the right stage of maturity, this would mean more pickings and would be too expensive to be economically sound practice. In New Zealand, they had had considerable trouble through fungal rotting of apples chiefly due to single species of *Penicillium*, and the loss from this source amounted to upwards of £30,000 per annum. It was found that the attacks invariably took place through injury and finally the grading machines were proved to be the cause of the damage. These machines had had to be largely discarded, though the extra labour involved in hand grading was considerable. Sanitation in the orchard and in the store very materially assisted in the reduction of fruit losses.

Dr. Horne (Imperial College of Science) stated that two problems centred round diseases of stored apples, the infection of the fruit and the subsequent spread in the host tissues. His studies had been concerned with the latter problem. Using the statistical method of estimating fungal invasion, he had found that there was a change in resistance in apples to fungal invasion in time ; in Bramleys there was a fall in resistance during storage, in Cox's Orange Pippin there was an apparent rise in resistance. Chemical analysis of Bramleys showed that change in acidity corresponded to a change in resistance. Striking differences in resistance were also observed in Bramley apples from different localitites and chemical analysis had shown that high resistance was associated with low N content and high K content ; acidity changes also corresponded. Worcester Pearmain apples gave a similar result, but acidity was not important in this case. If a number of apples were allowed to rot there were always some which remained a long time free from attack, and by using the half-apple method, those which showed rapid advance of rotting were found to contain 0.039 N while those showing slight advance only 0.034 N. There was no clear relation between other substances. Virulence might also be affected by saltation—*Fusarium* saltants of the section *Discolor* were less virulent than the parent, but with *Diaporthe*, *Cytosporina*, etc., saltants and parent were equally pathogenic.

Dr. Reichert (Palestine) gave an account of the fruit rots affecting tomatoes, almonds, bananas, grapes, and citrus in Palestine, and mentioned that the loss from wastage in Jaffa oranges alone amounted to £50,000 per annum. He stated that the treatment of citrus fruit by borax had given the most promising results in experiments against *Penicillium* rot in Palestine and he suggested that enquiry be made whether the present regulations of the Ministry of Health prohibiting the importation of borax-treated fruit into England could not be amended.

Mr. F. E. V. Smith (Jamaica) briefly described the banana industry and commented on the methods adopted in the storage of bananas during transit overseas.

Dr. Kidd (Low Temperature Research Station) stated that the results of chemical analyses of apples, in relation to the time of rotting of individuals, showed no relationship in the case of carbohydrates, whilst nitrogen gave a not very close relationship though those with high nitrogen tended to rot first. As in the case of internal breakdown, the speaker suggested that there might be two types of bitter pit, the one not apparent at picking but developing in store at low temperatures, the other visible and developing at high temperatures. Water core was preceded by a waterlogging of the tissues. It was thought that possibly all these troubles might be primarily concerned with the interference of gaseous exchange in the tissues.

Mr. Massey (Sudan) asked whether there was any breakdown of the tissues following waterlogging.

Prof. Blackman mentioned the occurrence of waterlogging in the tissues of shoots.

Dr. Pethybridge stated that waterlogging of tissues of tulips was followed by a falling over of the stalks. No actual necrosis took place but the tissues were ruptured.

Prof. Westerdijk mentioned attempts to reduce fruit rots by enclosing the fruit in rubber coatings in Holland.

Dr. Reichert stated that preliminary experiments carried out in Palestine with rubber coatings had so far given good results.

Dr. Cunningham, referring to the question of borax treatment raised by Dr. Reichert, suggested that the matter be taken up by the Imperial Bureau of Mycology with the Empire Marketing Board and the Ministry of Health.

Discussion: **"Soil borne and soil induced diseases (parasitic and non-parasitic) including those of cereals."**

Mr. Hansford (Uganda) introduced this subject by an account of Panama disease of the banana. The causal organism of this disease, *Fusarium cubense*, was able to grow in soil for an indefinite period and no system of crop rotation was likely to give successful control. A few plants in a badly diseased plot always remained healthy but the progeny of such plants gave no resistance over the average crop. The disease occurred on almost every type of soil and the speaker did not agree with Wardlaw's views that much land had had to be adandoned on account of poor cultivation and poor soil conditions, nor did he agree that improved cultural methods would control the disease. The only way to secure control of Panama disease was by breeding an immune variety, and the speaker considered that the problem of soil-borne diseases in the tropics was one for the plant breeder to solve.

Dr. Güssow (Canada) stated that great trouble had been experienced in Canada during the past two years with the take-all disease of wheat (*Ophiobolus graminis*). Mixed farming was not followed in the region of Canada concerned and the only way of controlling the disease was by breeding immune varieties. Results indicated that there was definite resistance in certain varieties and it might be hoped that varieties resistant to take-all as well as to *Puccinia graminis* might ultimately be developed.

Dr. Butler communicated some notes by Mr. G. Samuel on the manganese deficiency diseases of cereals in South Australia. The publication of the full paper was expected shortly in the *Annals of Applied Biology*.

Mr. Ashby gave an account of the root diseases of sugar-cane in British Guiana based on the researches of Bird and Altson. Evidence had not been obtained that the disease was caused by a parasitic organism but soil and plant analysis had indicated rather definitely that the failure of the cane was due to the toxic effect of magnesia rendered available in great amounts in the soil in contact with the roots by some factor not yet determined.

Dr. Cunningham (New Zealand) said that, in studies on take-all in New Zealand, areas were sown to cereals in successive years and the disease appeared in different parts of the plots. He then attempted to find out whether the seed was infected and definite information was obtained that a small proportion of seed infection occurs (3 in 10,000). But such seed sown in bulk gave no disease in the crop. With regard to dry rot of swedes (*Phoma lingam*), evidence was conclusive that it

was soil-borne in this country but under New Zealand conditions no increase of infection occurred in areas previously infected with dry rot. A soil-borne disease in one country might not be so in another.

Prof. Briton-Jones (Trinidad) considered that Dr. Wardlaw's results suggested that external conditions may influence the Panama disease.

Mr. F. E. V. Smith (Jamaica) mentioned a trouble of bananas in Jamaica associated with excess of manganese. He agreed that a resistant variety was the solution of the Panama disease problem, and crosses of Gros Michel and resistant types had been made with this aim in view. He stated that there are indications of less disease on alkaline soils than on acid ones.

Dr. Butler thought that the problem ought not to be left entirely to the plant breeder as there were undoubted cases where soil-borne diseases could be combated by improved cultural methods, rotation, and the like.

Dr. Pethybridge (Ministry of Agriculture) said that manganese deficiency occurred sometimes in Ireland and was remedied by applications of manganese sulphate. Heart rot of sugar beet had been attributed to *Phoma betae*, but the speaker found that the affected areas were alkaline and considered that this might be a predisposing factor to the disease.

Meeting: *Friday, 27th September*, 2.30 *p.m.*

Chair: Dr. Butler.

Paper: **"Methods of obtaining standardized proprietary disinfectants, with special reference to (*a*) coal-tar derivatives, (*b*) mercuric compounds."**

(The Malayan representatives, by whom this subject was proposed, obtained the consent of the Conference to withdraw it, in view of the fact that it was largely covered by the discussion on Subject VI on Wednesday afternoon, 25th September.)

Papers: **"Witches' broom disease of cacao."**

Mr. Ashby gave an account of the history, symptoms, causation, and control of the witches' broom disease of cacao in Surinam based on the researches of Stahel, as an introduction to a paper by Mr. Freeman on the distribution and control of the disease in Trinidad.

Mr. Freeman (Trinidad) described in detail the recent outbreak of witches' broom of cacao in Trinidad and the means taken for the control of the disease. The original infection was discovered in two places situated in hollows in the Central Range about five miles apart, located in a region of high rainfall. Subsequently a number of other isolated spots remote from railways or roads had been found infected. No evidence was available of the disease having been introduced by imported material and Stahel suggested air-borne spores might have been carried over, perhaps during a hurricane, from Surinam. The wild species *Theobroma speciosum*, which was susceptible to the disease, appeared to be absent from Trinidad and was not likely to be a carrier. The disease occurred chiefly in small holdings, and for the purposes of control gangs were organized, at Government expense, to remove and collect infected material from the trees and burn it. Data recorded of the effect of the control measures in two plots showed that at the start there were 70 and 60 per cent. infected trees, respectively, and after a year this had been reduced to from 7 to 8 per cent. Certain small farms were also purchased in the infected areas, which it was proposed to run on strictly commercial lines, using the best practice, in the hope of being able to demonstrate the feasibility of controlling the disease, and of proving to planters that the growing of cacao was still economically profitable.

Paper: **"The breeding of a commercial lime immune from wither-tip disease."**

Mr. Freeman (Trinidad) outlined the situation in the West Indies with regard to wither-tip of limes (*Gloeosporium limetticolum*) following the epidemic which broke out in Dominica in 1922. The Department of Agriculture in Trinidad got together a collection of varieties which had been reported to be resistant to the disease in

various parts of the world. None of them has proved a really satisfactory substitute for the West Indian lime, but Mr. R. O. Williams, Curator of the Botanic Gardens in Trinidad, has been successful in raising a number of hybrids between resistant varieties and the West Indian lime. One of these, a cross between *Citrus aurantifolia* and the West Indian lime, had given very promising results, and it was hoped to distribute it to planters as Trinidad hybrid No. 1.

Paper: **"The deterioration of produce by moulds."**

Mr. Bunting (Gold Coast) gave a detailed account of investigations made on the moulding of cacao beans in the Gold Coast. A few years ago the United States Government in accordance with the Pure Food laws of that country refused to admit certain consignments of cacao owing to mould, especially as certain cacao moulds belonged to groups containing human pathogens. Studies were therefore instituted of the moulds found on cacao beans in all stages of their preparation for market. A list of these were given, of special interest being *Aspergillus fumigatus*, said to be pathogenic to man, which was found in fermenting masses at temperatures up to 54° C. A good deal of work had been done to ascertain the minimum moisture content that would permit mould development, the safe degree of humidity for the storage of beans, the rates of drying, etc., so that a basis of reliable information was now available for comparison with the results of experimental work to be completed on a commercial scale. Similar work had been started on the moulding of copra. Quite recently the interest of the Empire Marketing Board was aroused in the deterioration of cacao and other produce brought into London from overseas and a grant of money was made for the investigation of the matter. The Stored Products Research Station has been established at Slough and a staff consisting of the Director, four entomologists, a chemist, and a mycologist has been appointed. A preliminary survey of the cacao storage in London warehouses had been made and it was hoped that it would be possible to get a connected story of the environmental conditions of given bags of cacao from the hands of the producer to the manufacturer's machinery and in this way to establish the points at which mould development normally took place. Active co-operation with the workers in the Gold Coast had been secured and similar co-operation with others would be welcomed.

Mr. South (Malaya) stated that the Department of Agriculture in Malay proposes to study the moulds that attacked copra in transit.

Prof. Briton-Jones outlined the programme of work at the Imperial College of Tropical Agriculture in Trinidad on the fermentation of cacao and stated he would be pleased to co-operate in any way with Mr. Bunting.

Mr. Dade appreciated the value to the Gold Coast of the new enterprise of the Empire Marketing Board. The standardization of the methods of observation and the determination of the qualities which manufacturers desired in cacao were matters on which more information was particularly desirable.

Meeting: *Saturday, 28th September*, 10.0 *a.m.*

Chair: Sir David Prain.

Discussion: **"The control of insect pests by entomogenous fungi, with special reference to island conditions."**

Mr. C. B. Williams (Amani) opened this discussion with an account of the attempted control of froghopper of sugar-cane in Trinidad by the green muscardine (*Metarrhizium anisopliae*). In spite of the abundance of entomogenous fungi in Trinidad he experienced many difficulties in effecting control and was unable to advise the use of the green muscardine as a commercial proposition. In Tanganyika entomogenous fungi were not one-tenth as abundant as in Trinidad and he thought that meteorological conditions played an important part in the incidence of the fungi. Control of insects by entomogenous fungi was not likely to be successful unless knowledge of the weather conditions was available, and such knowledge was very difficult to obtain for oceanic islands. Scale insects are naturally controlled

by entomogenous fungi in Trinidad and he had observed many times that if a windbreak became broken then an outbreak of these insects occurred in trees radiating from the point of breakage—a result attributed to the increased virility of the insects.

Mr. Freeman referred to the work of the Sugar-cane Froghopper Committee in Trinidad set up to deal with this pest and also remarked on the relative absence of scale insects in Trinidad.

Prof. Briton-Jones described the results of recent work on froghopper control by the green muscardine and was of opinion that there is little hope of effective control by this means. The effect of the break in the windbreak mentioned by Mr. Williams would be to weaken the exposed trees on which scale insects would then readily thrive.

Mr. Hansford and Mr. F. E. V. Smith agreed that scale insects developed vigorously with conditions which weaken the plant.

Dr. Gadd stated that entomogenous fungi abounded in Ceylon but no insect pest had as yet been controlled through their agency in the island. It is only when conditions were very favourable to entomogenous fungi that they thrived, and he agreed with Mr. Williams that successful control by such means would be very uncertain. He considered, however, that much more research was necessary before sound conclusions could be reached.

Dr. Butler said that scale insects appeared to have reached the Seychelles without their parasitic fungi, except perhaps, *Cephalosporium lecanii*. Entomogenous fungi were being collected at the Bureau for dispatch to the Seychelles just to see if any control of scales would be effected.

Mr. Bushell (Imperial Bureau of Entomology) stated that insects were usually favoured by the same weather conditions which favoured their parasites.

Mr. Williams thought that the sending of one or two experimental consignments of entomogenous cultures to the Seychelles fully justified but that, if no success were attained, it would not be worth while going further.

Mr. South also shared the view that climatic factors had a most important influence on entomogenous fungi.

APPENDIX Ia.

(*Official name of the Inspection Service and complete address.*)

Certificate No.

Certificate of Inspection.

This is to Certify that I (*name and position and address of authorized official*) have today and immediately prior to shipment thoroughly examined a representative sample of the living plants or plant products for which this certificate is required, contained in the following consignment(s): (*description of consignment*), stated to have been grown at (*locality where grown*); that the said plant or plant products have/have not been inspected in the field, that . . . (*any other remarks*).

And That I have been unable to discover any evidence of the presence of any insect pest or plant disease in said shipment, except as follows : .....

.....

In particular, the following pests or diseases have been looked for and not found :

.....

The consignment covered by this certificate has been treated in the following manner :

.....

Date of issue :

Place of issue

(*Official seal.*)

APPENDIX II.

Report of the Finance Sub-Committee set up by the Imperial Mycological Conference to examine and report on the financial position and organization of the Imperial Bureau of Mycology.

We were set up to examine and to report on the financial position and organization of the Imperial Bureau of Mycology, with special reference to the question of its financial requirements during the period 1930–31/1934–35.

We met on Tuesday, the 24th of September, when we had the opportunity of examining estimates and other documents submitted to us by Dr. Butler, and of hearing statements from him and from the Secretary to the Managing Committee, regarding the present financial position of the Bureau. We are satisfied, after a full examination of the Bureau's present position and of the estimates submitted by Dr. Butler, that if the normal work of the Bureau, which has increased greatly and may be expected to continue to do so, is to be satisfactorily carried on, an average additional income of £1,200 a year must be secured. This additional income is chiefly required to defray increased expenditure which will be necessary on account of the development of the Bureau's activities and the occupation of the new building, but it would also make possible the appointment in two or three years' time of an additional Scientific Officer to the Bureau staff, a step which we are convinced will be entirely necessary owing to the extension of the Bureau's work.

We did not regard it as within our terms of reference to examine possible means by which the additional income recommended might be secured ; but we desire to place on record our disappointment at learning that the Imperial Government has hitherto made no annual grant towards the Bureau, and our hope that it will be found possible for such a grant to be made in future, as in the case of the Imperial Bureau of Entomology.

We took the opportunity to examine, also, certain proposals for special work to be undertaken by the Bureau during the next five years, which, if adopted, would involve special or increased expenditure. Among these were :—

(*a*) The preparation of maps showing the distribution throughout the world of the more important plant diseases. This work would necessitate the employment by the Bureau, for a considerable period, of additional clerical assistance, and would involve special non-recurrent expenditure estimated tentatively at £300. We consider that the proposed work would be of value and we hope that the sum required in this connection may be made available.

(*b*) The preparation, after 1930, of a ten-year index of *The Review of Applied Mycology*. We understand that the estimated cost of this publication (not allowing for income derived from sales of the index) would be approximately £1,500. We are strongly of the opinion that the preparation of such an index would be likely to prove of very considerable value, but we think that it would be preferable if details connected with this question could be further discussed between the Director of the Bureau and the Director of the Imperial Bureau of Entomology, and if it could be submitted at a later date to the Managing Committee of the Bureau for a decision.

(*c*) The extension of the system of overseas travel by members of the Bureau staff to Dominions and Colonial Dependencies to co-operate with the local staffs in the study of plant diseases. We are fully convinced of the advantages derived from such visits, both by the Bureau and by the territories visited, and we considered it most desirable that such visits should, if possible, be extended and made more frequent. This can only be done if the Bureau staff is increased by the appointment of an additional senior Scientific Officer, which would involve approximate additional expenditure of £1,000 a year. We recommend that an endeavour should be made to secure additional income for the Bureau sufficient to enable the appointment to be made for the purpose proposed.

(*d*) The question whether the Bureau should undertake the publication of certain important mycological works which can no longer be purchased. We discussed this fully, and came to the conclusion that while the publication of such works was,

without doubt, desirable, it would be preferable if this question could be further discussed at the International Botanical Conference, which is to take place in 1930. We accordingly recommend that the Conference should place on record its view of the desirability of the re-publication of such works and should request that the necessary steps should be taken to ensure that it is discussed at the International Botanical Conference in 1930.

We have no observations on the present general organization of the Bureau. Subject to what is said above as to the desirability of certain increases of staff in the future, this organization appears to be admirably designed to carry out the Bureau's work.

28th September, 1929.

Minutes of a Meeting of the Finance Sub-Committee of the Managing Committee of the Imperial Bureau of Mycology.

HELD AT 3 P.M., ON TUESDAY, THE 18TH JUNE.

Present: SIR JOHN FARMER (*in the Chair*), DR. HILL, DR. RENDLE, DR. BUTLER (*Director*), MR. LEE (*Secretary*).

1. Dr. Butler explained briefly the present financial position of the Bureau. He pointed out that there would be an excess of expenditure over revenue during the current year, which was inevitable in view of the fact that expenditure increased steadily over the period of five years (by the natural operations of increments, etc.), while the Bureau's income remained constant and was calculated on the average annual requirement for the five years. In the detailed estimate * of the Bureau's requirements for the period 1930–31 to 1934–35, which had been circulated to the Sub-Committee, that deficit would (assuming that the Bureau's income remained at the present figure) be raised to at least £1,000 a year on the average for the five years, being less than £1,000 in the earlier years and more in the later. The question to be considered by the Sub-Committee was whether the estimate of increased expenditure for the period in question was a reasonable one.

2. The Sub-Committee then proceeded to examine in detail the estimate submitted by the Director. It was noted that a large proportion of the increase in expenditure was due to the payment of increments in the salaries of the Bureau Staff. The Sub-Committee felt that generally the payment of the increments proposed would be fully justified, but that it would be preferable if definite scales of salary could now be framed for the Bureau staff, with fixed minima and maxima, instead of the continuance of the present method, whereby salaries normally increased from year to year, but were not actually adjusted to any definite scale. After discussion, they agreed to recommend to the Managing Committee the adoption of the following scales, the present position within his scale of each member of the staff not being affected :—

Post.	*Salary for 1929–30.*	*Present increment.*	*Scale proposed.*
1. Director	£1,200 fixed	—	No present change
2. Assistant Director	£780	£20	£700—20—900
3. Mycologist	£860†	£20	£700—20—900
	† (£100 personal allowance)		
4. Assistant Mycologist	£650	£20	£550—20—750
5. Senior Abstractor	£380	£10	£300—10—420
6. Second Abstractor	£370	£10	£300—10—400
7. Third Abstractor	£315	£10	£300—10—400
8. Senior Clerk and Secretary ...	£228	£5	£175—5—260
9. Publication Clerk	£156	£5	£150—5—200
10. Junior Clerk	£130	£5	£130—5—175
11. Laboratory Attendant	£190 fixed	—	No change.

* Annex.

It was pointed out that the adoption of the scales proposed would actually mean a slight saving in the estimate submitted by the Director, in that this allowed for the payment of increments to each officer throughout the whole period 1930–31 to 1934–35, whereas under the scheme proposed the Mycologist and the Senior and Second Abstractors would reach the maxima of the scales for their posts by 1931–32, 1933–34, and 1932–3, respectively.

It was agreed that, in making new appointments to the staff, the Director should have authority to offer a salary in excess of the minimum to be attached to the post if the standing of the candidate warranted this. The Secretary was instructed to draw up, for the information of the full Managing Committee, a comparative list showing the scales proposed and those attached to equivalent posts in the Imperial Bureau of Entomology.

3. The Sub-Committee noted that there was at present a deficit, amounting to £460 in the current year, on the publication of the *Review of Applied Mycology*, and that, in the Director's estimate this was shown as rising to £560 in 1934–35. Dr. Butler explained that the present deficit was almost wholly due to the fact that 300 copies of the *Review* were supplied free each month to the contributing Governments. He anticipated no increase in the deficit on the publication of the *Review* itself; the increase shown in his estimate was in respect of additional publication which the Bureau would have to carry out in the near future, e.g., the publication of various lists (of research workers, etc.) which had been entrusted to the Bureau in accordance with recommendations of the Imperial Agricultural Research Conference, and which had been accepted by the Managing Committee. The Sub-Committee felt that it would be useful if Dr. Butler could draw up a supplementary memorandum, showing fully the reasons for the present deficit and the anticipated increased expenditure on publications. It was also decided to recommend that consideration should be given to a further increase in the price of the *Review* in, say, a year's time (so as to reduce the deficit), provided that this course would not embarrass the Imperial Bureau of Entomology.

4. The Sub-Committee considered the small increases estimated in expenditure on Apparatus and Furniture, Office and General Charges and Superannuation to be justified, and, indeed, inevitable. The Secretary was, however, instructed to inquire whether the Bureau's correspondence with Government Departments at home and overseas could not be franked, as, if this could be done, a considerable saving would result. The Sub-Committee thought the Director's estimate of the increased expenditure which would be necessary as a consequence of the occupation of the new building from October, 1930, as accurate a one as could be framed at present. The other items on the estimate—such as the Overseas Travel Fund—did not vary from year to year.

5. Subject to consideration being given to their recommendations regarding the salaries of the Bureau staff, and regarding the deficit on the publication of the *Review of Applied Mycology*, the Sub-Committee desired to record its approval of the Director's estimate. It also decided to recommend that provision should be made for the appointment of an additional member to the Bureau staff in about three years' time, as it was convinced that the continued increase in the Bureau's work would necessitate such an appointment. This would involve an additional expenditure of about £500 a year for the last two years of the period 1930–31 to 1934–35. In other words, the average deficit over the five years would rise to £1,200 a year.

6. As regards procedure, the Sub-Committee agreed that their recommendations should be formally submitted to the full Managing Committee at its meeting on the 10th July. Whatever financial programme this approved should be submitted for examination by a sub-committee of the forthcoming Conference, which would include Directors of Agriculture, Mycologists from the Dominions and Colonies, and members of the Managing Committee. This would present a report to the Conference on the matter.

7. The Sub-Committee examined briefly a proposal that the Bureau should participate in a scheme (which has been approved by most Colonial Governments) whereby the Crown Agents for the Colonies will place all the cash balances lying from time to time in their hands in a joint fund, so that the sums available can be dealt with on more comprehensive lines. The Sub-Committee decided to recommend the Bureau's participation in the scheme.

ANNEX.

In the attached statement the actual expenses of the Bureau for the current year (excluding the special charges that may be incurred in connection with the Mycological Conference) are given in the first column, and the estimated expenditure for each of the succeeding five years is given in the next five columns, the addition over the previous year in any single item and in the totals being shown in brackets. In the last column is shown the revenue of the Bureau on the present scale of Government contributions, an additional £150 being allowed for interest on the Bureau balances, which will be seriously depleted by the contribution towards the cost of the new building.

The result is a deficit of nearly £1,000 a year on the average of the five years from 1930–31.

No provision has been made for increase of staff during the coming quinquennial period, but it is certain that if the work of the Bureau increases at the same rate as it has in the past (and this rate is likely to be exceeded as new posts are created in the Agricultural Departments in the Dominions and Colonies) the present staff will not be able to cope with it beyond another two or three years. If the Bureau is to do the work it is called on to do adequately in future it will require an additional £500 a year for a new assistant and his expenses in, say, three years from now.

I.

STATEMENT OF EXPENDITURE FOR THE CURRENT YEAR, AND FOR THE NEW QUINQUENNIAL PERIOD 1930–1935 IF SALARY INCREMENTS ARE MAINTAINED AT PRESENT RATES UP TO THE MAXIMA OF THE SCALE, AND ASSUMING THAT BUREAU STAFF REMAINS ON PRESENT BASIS

(The figures in brackets indicate increase or decrease from the previous year.)

	1929–30.	1930–31.	1931–2.	1932–3.	1933–4.	1934–35.	*Remarks.*
	£	£	£	£	£	£	
Salaries (see details on separate sheet).	5,302	5,407 (+105)	5,512 (+105)	5,597 (+85)	5,672 (+75)	5,737 (+65)	—
Library	100	100	100	100	100	100	—
Apparatus and furniture	75	75	75	90 (+15)	90	90	—
Publications (net deficit)...	460	500 (+40)	500	500	500	500	This item is impossible to estimate accurately.
Office and general charges	180	190 (+10)	190	200 (+10)	200	210 (+10)	A similar rate of increase to that in past 5 years.
Rent	30	30	30	30	30	30	—
Superannuation	465	480 (+15)	480	494 (+14)	497 (+3)	505 (+8)	Increases depend on salary increments.
Overseas travel fund ...	200	200	200	200	200	200	—
Miscellaneous	45	45	45	45	45	45	Travelling expenses of Bureau Committee.
Additional for new building—							
Gas, electricity, water, heating.	—	18 (+18)	36 (+18)	36	36	36	—
Cleaning	—	20 (+20)	39 (+19)	39	39	39	—
Upkeep...	—	5 (+5)	10 (+5)	10	*60 (+50)	10 (−50)	*Painting must be done under terms of lease.
Contingencies	—	75 (+75)	75	75	75	75	
Total	£6,857	7,145	7,292	7,416†	7,544†	7,577†	
Increase over preceding year.		(288)	(147)	(124)	(128)	(33)	
Total expenditure for the 5 years 1930–1 to 1934–5				36,974			
Average expenditure per annum				£7,395			

† *Does not include provision for any increase of staff* (2 additional appointments have been suggested).

STATEMENT OF INCOME ON EXISTING SCALE OF CONTRIBUTIONS DURING THE 5 YEARS FROM 1930–1.

	£
Government grants...	6,300
Interest...	150
Total	6,450
Average deficit for the 5 years.	†945
	£7,395

II.

DETAILS OF SALARIES.

	1930–1.	1931–2.	1932–3.	1933–4.	1934–5.	Scale.
	£	£	£	£	£	£
Director...	1,200	1,200	1,200	1,200	1,200	
Assistant Director	800	820 (+20)	840 (+20)	860 (+20)	880 (+20)	700–20–900
Mycologist	880	900 (+20)	900	900	900	700–20–900
Assistant Mycologist	670	690 (+20)	710 (+20)	730 (+20)	750 (+20)	550–20–750
Senior Abstractor	390	400 (+10)	410 (+10)	420 (+10)	420	300–10–420
Second Abstractor	380	390 (+10)	400 (+10)	400	400	300–10–400
Third Abstractor	325	335 (+10)	345 (+10)	355 (+10)	365 (+10)	300–10–400
Senior Clerk and Secretary	233	238 (+5)	243 (+5)	248 (+5)	253 (+5)	175–5–260
Publication Clerk	161	166 (+5)	171 (+5)	176 (+5)	181 (+5)	150–5–200
Junior Clerk	135	140 (+5)	145 (+5)	150 (+5)	155 (+5)	130–5–175
Laboratory Attendant	190	190	190	190	190	190 fixed.
Charwoman	39	39	39	39	39	
Overtime	4	4	4	4	4	
Increment totals		(105)	(85)	(75)	(65)	
Salary totals	£5,407	5,512	5,597	5,672	5,737	

APPENDIX III.

Report of the Committee appointed to consider the formulation of a standard method of handling dangerous material (specimens and cultures) in mycological laboratories.

The committee appointed to consider this subject is able to make the undermentioned recommendations :—

1. *Transmission of specimens of plant diseases from one country to another country.*

(*a*) Fresh specimens of a plant carrying a dangerous disease should not be transmitted from a mycological laboratory in one country to a mycological laboratory in another country where that plant or other susceptible plants are under cultivation, but are free from the disease ; if such specimens are received, they should be burnt without delay together with the packing material, or be rendered innocuous in some other effective way.

(*b*) In the event of such specimen being transmitted as an " exsiccatum," it should be poisoned before dispatch (e.g., by painting it with or dipping it into a 1 per cent. solution of mercuric chloride in strong alcohol) and be marked " poisoned."

2. *Cultures of plant pathogenic organisms.*

When cultures of such organisms (in plates, tubes, etc.) are being discarded, they should be killed, either by flooding them with a mixture of strong alcohol and formaldehyde solution, or of a 1 per cent. solution of mercuric chloride in strong alcohol, and be allowed to lie in contact with the poison for several hours, *or*, if more convenient, by heating in the autoclave under pressure or in a steamer at, or very near to 100° C., for a half hour at least.

3. *General treatment of specimens of dangerous diseases.*

Fresh specimens of plant material infected (or suspected to be infected) by a dangerous disease, which have been collected in a country and taken to a mycological laboratory there, should, after portions have been selected for preserving or culturing, be destroyed as soon as possible by fire in an incinerator which ought to be a part of the equipment of all mycological laboratories.

4. A copy of the preceding three recommendations should be posted in all mycological laboratories.

The committee recommend also that the undermentioned two resolutions be put before the Conference :—

1. That special care be taken in the handling of dangerous specimens in mycological laboratories where teaching is carried on.

2. That teachers of plant pathology, if they do not do so already, give careful consideration to the possible risk of introducing cultures of plant pathogenic organisms into countries where diseases caused by those organisms do not occur.

APPENDIX IV.

Report of the committee appointed to consider the need for a series of handbooks on the diseases of tropical and sub-tropical crops.

The committee begs to report that it is of opinion that a series of handbooks on the diseases of the most important tropical and sub-tropical crops is needed ; and they recommend that :—

(1) The following crops should be dealt with in this series :—

(*a*) Sugar-cane.
(*b*) Cocoa.
(*c*) Tobacco.
(*d*) Cotton.
(*e*) Coconut and other Palms.
(*f*) Bananas and other fruits (excepting Citrus Fruits).
(*g*) Tropical Cereals and Rice.
(*h*) Ground Provisions.
(*i*) Coffee.
(*j*) Rubber.
(*k*) Tea.

(2) Each handbook be compiled by an Editor to be selected by the Imperial Bureau of Mycology and that, where the Editor is a member of a Colonial Government Service, duty leave should be granted him to facilitate the preparation of the book.

(3) Each handbook should be written in language suited to the needs of more advanced planters, with all important technical material incorporated in smaller type.

(4) Each Editor will draw fully on all previous published work, giving references, for a general account of each disease, and shall endeavour to obtain by means of *questionnaires* any additional information he may require from mycologists in the Colonies and Dominions.

(5) In each handbook special attention be devoted to such aspects of disease as :—

(*a*) the relation of disease to varied agricultural practice ;

(*b*) varietal resistance to disease, naming resistant varieties in detail ;

(*c*) agricultural methods of control as distinct from such methods as spraying and dusting ;

(*d*) good illustrations and accurate description of each disease.

(6) In each handbook such matters as the existence of gaps either in our knowledge of any disease or in the development of control measures suitable for use under tropical conditions should be indicated, as suggesting lines for future research.

(7) The Imperial Bureau of Mycology should supervise the organization and publication of the series and act as General Editors.

(8) With reference to publication, the Imperial Bureau should approach the Colonial and Dominion Governments particularly interested in each handbook as well as large commercial interests, for subsidy to enable the handbooks to be sold at such a price as would appeal to planters.

(9) Finally, the Committee wishes to emphasize that the series must be of outstanding merit, otherwise it would be preferable to drop the scheme altogether.

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Report by the Hon. E. F. L. Wood, M.P., on his visit during the period December, 1921, to February, 1922 [Cmd. 1679]. 3*s.* 0*d.* (3*s.* 2*d.*).

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REPORT OF THE SECOND IMPERIAL ENTOMOLOGICAL CONFERENCE.

June, 1925. [Cmd. 2490.] 9*d.* (10*d.*).

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Report by the Hon. W. G. A. Ormsby Gore, M.P., on his visit during the year 1926. [Cmd. 2744.] 3*s.* 6*d.* (3*s.* 9*d.*).

IMPERIAL CONFERENCE, 1926.

Summary of Proceedings. [Cmd. 2768.] 1*s.* 0*d.* (1*s.* 1*d.*).
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Summary of Proceedings. [Cmd. 2883.] 1*s.* 3*d.* (1*s.* 4*d.*).
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Report of a Committee appointed by the Secretary of State for the Colonies. [Cmd. 3049.] 9*d.* (10*d.*).

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MALAYA, CEYLON, AND JAVA.

Report by the Rt. Hon. W. G. A. Ormsby Gore on his visit during the year 1928. [Cmd. 3235.] 4*s.* 6*d.* (4*s.* 9*d.*).

COLONIAL VETERINARY SERVICE.

Report of a Committee appointed by the Secretary of State for the Colonies. [Cmd. 3261.] 9*d.* (10*d.*).

REPORT OF THE IMPERIAL MYCOLOGICAL CONFERENCE, 1924.

(Colonial No. 8.) 9*d.* (10*d.*).

COLONIAL RESEARCH COMMITTEE.

Report, 1926 to 31st March, 1928. (Colonial No. 38.) 3*d.* (4*d.*).

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Third Report -	*FRUIT.*	[Cmd. 2658.]	4*s.* 6*d.* (4*s.* 10*d*).
Fourth Report -	*DAIRY PRODUCE.*	[Cmd. 2725.]	1*s.* (1*s.* 2*d.*).
Fifth Report -	*FISH.*	[Cmd. 2934.]	6*d.* (8*d.*).
Sixth Report - -	*POULTRY AND EGGS and*		
Seventh Report -	*HONEY.*	[Cmd. 3015.]	1*s.* (1*s.* 2*d.*).
Eighth Report -	*FUNCTIONS AND GENERAL WORKING of the IMPERIAL ECONOMIC COMMITTEE.*	[Cmd. 3018.]	6*d.* (7*d.*).
Ninth Report -	*TOBACCO.*	[Cmd. 3168.]	9*d.* (10*d.*).
Tenth Report -	*TIMBER.*	[Cmd. 3175.]	9*d.* (10*d.*).
Eleventh Report	*A SURVEY of the TRADE in AGRICULTURAL MACHINERY.*		6*d.* (8*d.*).
Twelfth Report -	*PIGS AND PIG PRODUCTS.*		6*d.* (8*d.*).

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